TAB 1

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IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

ROHM AND HAAS COMPANY,	:	
	:	
Plaintiff,	:	
	:	
v.	:	Civil Action No. 90-109-JJF
	:	
BROTECH CORPORATION,	:	
	:	
Defendant.	:	

Rudolf E. Hutz, N. Richard Powers, Jeffrey B. Bove, and Patricia Smink Rogowski, of CONNOLLY BOVE LODGE & HUTZ, Wilmington, Delaware. Attorneys for Plaintiff.

Robert K. Payson, and William J. Marsden, Jr., of POTTER ANDERSON & CORROON, Wilmington, Delaware. Raphael V. Lupo, Jack Q. Lever, Jr., Donna M. Tanguay, and Robert W. Zelnick, of WILLIAN BRINKS OLDS HOFER GILSON & LIONE, Washington, DC. Herbert B. Keil, of KEIL & WEINKAUF, Washington, DC. Paul R. Rosen, and Niels Korup, of SPECTOR GADON & ROSEN, Philadelphia, Pennsylvania. Attorneys for Defendant.

O P I N I O N

June 30, 1995

Wilmington, Delaware

Joseph J. Farnan Jr.

FARNAN, District Judge.

I. INTRODUCTION

This action was filed by Rohm and Haas Company[1] on March 1, 1990 seeking damages and injunctive relief from Brotech Corporation[2] for Brotech's alleged willful infringement of United States Patent Numbers 4,224,415 ("the '415 patent"), 4,382,124 ("the '124 patent") and 4,256,840 ("the '840 patent"). (D.I. 1). On April 27, 1990 Brotech answered the Complaint and counterclaimed seeking a declaration that the patents are invalid, unenforceable, and not infringed. (D.I. 7). Brotech amended its Answer and Counterclaim on November 27, 1991. (D.I. 257).

The Court has jurisdiction over the parties and the subject matter on Rohm and Haas' patent infringement claim pursuant to 28 U.S.C. § 1338(a). The Court has jurisdiction over Brotech's counterclaims pursuant to 28 U.S.C. §§ 1338(a) and 2201(a). Venue is proper in this District pursuant to 28 U.S.C. § 1400(b) as both Brotech and Rohm and Haas are residents of Delaware by reason of their incorporation in Delaware.

The Court held a bench trial on the issues of infringement, willful infringement, validity, enforceability, damages, enhanced damages and attorneys fees. The following

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1. Plaintiff Rohm and Haas Company is a corporation organized and existing under the laws of the State of Delaware. Its principal place of business is Philadelphia, Pennsylvania. D.I. 597, at ¶1.1.

2. Defendant Brotech Corporation is a corporation organized and existing under the laws of the State of Delaware. Its principal place of business is Bala Cynwyd, Pennsylvania. D.I. 597, at ¶1.2.

Opinion contains the Court's Findings of Fact and Conclusions of Law with respect to each of these issues.[3]

II. FACTUAL BACKGROUND

A. Basic Concepts Relating to the Patents

The Meitzner-Oline patents in dispute are directed to the production of copolymer beads and the ion exchange resins and adsorbents made from them. Copolymer beads of the type described here are produced by polymerizing two monomers using a technique called suspension polymerization. Monomers are small chemical molecules that are the basic building blocks of polymers. The attachment of two or more monomers to each other forms a polymer. The reaction of monomers to form a copolymer is called polymerization. The most common monomers used in the ion exchange technology are styrene and divinylbenzene.

When two monomers are polymerized, two types of crosslinking occur. First, the cross-linking monomer, typically divinylbenzene, causes a chemical crosslinking. Second, crosslinking occurs as a result of physical entanglement of the linear polymer chains formed during polymerization. Crosslinking connects linear polymer chains to each other and makes the copolymer insoluble. Albright, Tr. at 62-63.

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3. Arguments not specifically addressed in the Opinion were considered to be without merit or inconsequential to the outcome of the case. In addition, the Court will enter a separate Memorandum Opinion and Order disposing of the evidentiary issues briefed by the parties

Polymerization which takes place while the monomers are suspended in an aqueous medium is called suspension polymerization. Suspension polymerization involves mixing together two liquid monomers, a dispersing agent and an initiator, and then suspending the mixture in another liquid in which the monomers are insoluble, most commonly water. Albright, Tr. at 66-68. The mixture is then agitated to cause the monomer mixture to disperse. The dispersing agent provides stability to the monomer droplets so that they retain their droplet status long enough for the solid copolymer to form.

The application of heat activates the initiator which causes the monomers in the liquid droplets to link together or polymerize to form insoluble copolymer beads. Albright, Tr. at 68-69. The copolymer beads produced are roughly the same size as the liquid droplets that were in suspension at the start of the polymerization. Albright, Tr. at 69-70.

Ion exchange resins are formed from the basic copolymer bead by a process called "functionalization." (D.I. 597, at ¶3.5). Functionalization refers to the attachment of chemical groups onto the basic copolymer bead in order to impart ion exchange capabilities. Albright, Tr. at 52. Once the functional groups are attached, the beads have the capability to attract and hold ions.

Ion exchange is performed by passing an ion-containing liquid through an ion exchange resin. Certain ions in the liquid are attracted to the functional groups in the exchanger and are temporarily held by it. A cation exchange resin exchanges positive

ions and therefore has negative ions built into it. An anion exchange resin exchanges negative ions and therefore has positive ions in its framework. PX 2429, ¶7. After use, the ions which have been temporarily attracted to the ion exchange resin can be removed, thereby allowing the ion exchange resin to be reused.

Ion exchange resins can be divided into two major subclasses based on the physical structure of the copolymer beads: those made with gel type beads and those made with macroporous beads. A gel bead is a solid copolymer having little or no porosity. It is characterized by its transparent, glassy appearance. The only porosity associated with gel beads is the spaces between overlapping chains of polymers. In the dry state these pores range in size from 2 to 5 **A**. When the gel is hydrated, the polymer chains move apart, producing pores up to 30 **A** in diameter. The porosity associated with gel resins is referred to as molecular porosity.

Macroporous[4] beads, on the other hand, have fixed pores even in the dry state. Macroporous beads are permeated by relatively large, interconnected pores that can range in size from 40 to 200,000 A. Albright, Tr. at 93-95; PX 2253, at 17549-50. Beads of this type have micropores, as found in the gel resins, as well as "macropores." Macroporous beads typically look opaque or

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4. There is much confusion and disagreement over the labels used to describe the copolymer beads of greater porosity. For sake of clarity, the Court will use the term macroporous to describe the general class of copolymer beads and ion exchange resins which contain significant non-gel porosity, without reference to the particular method employed to achieve the non-gel porosity.

translucent when viewed under a microscope. Abrams, Tr. at 1151-52.

Because of their permanent pore structure, macroporous resins allow improved access to the bead interior, low resistance to flow, good osmotic strength, and higher resistance to oxidation as compared to gel-type beads. Abrams, Tr. at 1153, 1196-97; Albright, Tr. at 58-59, 90-91, 103-105; Oline, Tr. at 324-26; Stoebenau, Tr. at 517-18; PX 2429, at ¶12; PX 2245, at 7345-46.

Ion exchange resins have a wide variety of industrial applications. The largest use is the production of high-quality industrial water for various industries, such as the nuclear power and electronics industries. Other ion exchange resin uses include water softening, sugar refining, waste treatment, chemical analysis, metal recovery, and pharmaceutical manufacturing. Albright, Tr. at 55-56, D.I. 597, at ¶3.2; Stobenau, Tr. at 525-29, 531, 556.

B. The Patents

Rohm and Haas filed United States Patent Application Serial Number 749,526 on July 18, 1958, naming Erich F. Meitzner and James A. Oline[5] as inventors and Rohm and Haas as assignee. Two divisional applications evolved from the original '526

5. Dr. Erich Meitzner and Mr. Oline were employees of Rohm and Haas at the time they made the inventions patented in the patents-in-suit. Each assigned all of his rights in the inventions and any patents issuing from the inventions to Rohm and Haas. Dr. Meitzner died in 1992. (D.I. 597, at ¶¶ 4.1-4.2). Mr. Oline testified at trial.

application and all three patents in suit ultimately issued from the '526 application. MacPeak, Tr. at 1594-95.

United States Patent 4,224,415, entitled "Polymerization Processes and Products Therefrom," issued directly from the '526 application on September 23, 1980. (D.I. 597, at ¶4.3). United States Patent 4,256,840, entitled "Macroreticular Cation Exchange Beads and Preparation of Same," issued on March 17, 1981 from Application Serial Number 41,166, a division of the '526 application. (D.I. 597, at ¶4.4)[6] United States Patent 4,382,124, entitled "Process for Preparing Macroreticular Resins, Copolymers and Products of Said Process," issued on May 3, 1983 from Application Serial Number 156,004, also a division of the '526 application. (D.I. 597, at ¶4.6). All three patents have been owned by Rohm and Haas from the time they were issued. (D.I. 597, at ¶¶4.3-4.7).

The Meitzner-Oline patents asserted against Brotech describe a method for the production of a particular species of macroporous beads (termed macroreticular by Rohm and Haas) having a continuous gel phase and a continuous pore phase. The patents employ standard suspension polymerization techniques for producing the copolymer beads. However, the Meitzner-Oline patents alter this basic polymerization process by adding a liquid, called a precipitant, to the monomer mixture. The precipitant, as defined

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6. The '840 patent will expire on September 23, 1997, the same date the '415 patent will expire, because Rohm and Haas filed a terminal disclaimer during the prosecution of the '840 patent to disclaim the remaining portion of the 17-year term of the '840 patent. (D.I. 597, at ¶4.5).

in the patent, must be soluble in the monomers such that the initial monomer droplets--containing initiator, monomers and precipitant--is a homogenous solution. As copolymerization proceeds, the precipitant, which is a nonsolvent for the forming copolymer, causes the copolymer to precipitate or phase separate inside each individual droplet. As precipitation proceeds, the copolymer forms into small microgels. The number and size of the microgels increase until they touch and agglomerate into an overall structure permeated by large interconnected channels. Once polymerization is complete, the initially suspended liquid droplets have been converted to many small copolymer beads, which can then be recovered and used as adsorbents or functionalized for use as ion exchange resins.

III. INFRINGEMENT

Infringement occurs when someone "without authority makes, uses or sells any patented invention within the United States during the term of the patent . . . ." 35 U.S.C. § 271. (1988). Plaintiffs must prove infringement by a preponderance of the evidence. See, e.g., Smithkline Diagnostics, Inc. v. Helena Labs. Corp., 859 F.2d 878, 889 (Fed. Cir. 1988). The Court's determination of infringement involves two steps. First, the Court must determine the scope of patent claims in issue. Autogiro Co. of America v. U.S., 384 F.2d 391, 401 (Ct. Cl. 1967).

> The claims of the patent provide the concise formal definition of the invention. They are numbered paragraphs which "particularly [point] out and distinctly [claim] the subject matter which the applicant regards as his invention." It is to these wordings that one

> must look to determine whether there has been infringement. Courts can neither broaden nor narrow the claims to give the patentee something different than what he has set forth. . . . Although courts are confined to the language of the claims, they are not, however, confined to the language of the claims in interpreting their meaning.
>
> . . . .
>
> In deriving the meaning of a claim, we inspect all useful documents to reach what Justice Holmes called the "felt meaning" of the claim.

Id. at 396-397 (quoting 35 U.S.C. § 112). This requires the Court to interpret the language of the asserted claims of the patents. The language in a claim should be interpreted as one reasonably skilled in the art would interpret the claims unless the inventor provides a different meaning to the words. Envirotech Corp. v. Al George, Inc., 730 F.2d 753, 759 (Fed. Cir. 1984). In interpreting the disputed claims, the Court looks to several factors including: (1) the literal language of the claims, (2) the patent specification, (3) the prosecution history, and (4) expert testimony on how those skilled in the art would interpret the claim. Loctite Corp. v. Ultraseal Ltd., 781 F.2d 861, 867 (Fed. Cir. 1985); American Standard Inc. v. Pfizer Inc., 722 F. Supp. 86, 92 (D. Del. 1978). But, "interpreting what is meant by a word in a claim 'is not to be confused with adding an extraneous limitation appearing in the specification.'" Intervet America v. Kee-Vet Labs., 887 F.2d 1050, 1053 (Fed. Cir. 1989) (quoting E.I. Du Pont de Nemours & Co. v. Phillips Petroleum Co., 849 F.2d 1430, 1433 (Fed. Cir. 1988), cert. denied, 488 U.S. 986 (1988)). Moreover,

claims must be construed to uphold their validity if at all possible. Loctite Corp., 781 F.2d at 867.

Once the Court establishes the meaning of the claim, the claim must be read on the accused products or processes to determine whether the accused products or processes infringe on the patent, either literally or under the doctrine of equivalents. Autogiro, 384 F.2d at 401. Literal infringement occurs if a claim of the patent reads on the alleged infringer's product or process. A claim reads on an alleged infringer's process if each element of the claim is found in the process. See American Hoist & Derrick Co. v. Manitowoc Co., Inc., 603 F.2d 629, 630 (7th Cir. 1979). Rohm and Haas contends that Brotech is literally infringing the '124 and '840 patents, and infringing the '415 patent under the doctrine of equivalents.

A. The '124 Patent

The '124 patent is directed towards macroreticular copolymer beads and the methods of their production. Rohm and Haas alleges that Brotech has literally infringed Claims 1, 4, 8, 9 and 10, of the '124 patent.

1. Claim 1

a. Claim Interpretation

Claim 1 of the '124 patent states:

> A process for preparing reticular crosslinked copolymer beads of high specific surface have controlled reduced apparent density of at least about 0.02 density units less than the apparent density of gel-type copolymer beads of the same composition made in absence of liquid precipitant, which comprises suspension copolymerizing in an

claims must be construed to uphold their validity if at all possible. Loctite Corp., 781 F.2d at 867.

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A. The '124 Patent

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1. Claim 1

a. Claim Interpretation

Claim 1 of the '124 patent states:

> A process for preparing reticular crosslinked copolymer beads of high specific surface have controlled reduced apparent density of at least about 0.02 density units less than the apparent density of gel-type copolymer beads of the same composition made in absence of liquid precipitant, which comprises suspension copolymerizing in an

> aqueous medium (1) a polyvinylidene monomer containing a plurality of ethylenically unsaturated groups in non-conjugated relationship and (2) a monovinyl aromatic hydrocarbon monomer in a liquid precipitant which (a) has a low solubility in the aqueous medium, (b) is a solvent for the monomer mixture and (c) does not appreciably swell the copolymer of said polyvinylidene monomer and said monovinyl aromatic hydrocarbon monomer, said liquid precipitant and said polyvinylidene monomer each being present in an amount exceeding the critical concentration of each needed for phase separation of the copolymer from the monomer phase as the copolymer is formed, and recovering the copolymer beads so formed.

Claim 1 teaches a process for making a macroporous bead which includes the following elements as interpreted by the Court:

(1) Reticular cross-linked copolymer beads . . .

Claim 1 teaches the formation of a reticular copolymer structure. The inventors define a reticular structure as "the unique structure of the polymers . . . produced by the herein disclosed phase separation technique utilizing a precipitating agent." PX 2011, Col. 5, ll. 40-43. The unique reticular structure referred to is the agglomeration of "randomly packed microspheres," and contains a continuous polymer phase and continuous void or pore phase. The pores are actually channels between the agglomerates of the gel microspheres. It is the agglomeration of gel microspheres that form the continuous copolymer phase and continuous pore phase that distinguishes the Meitzner-Oline resins from those made by other processes.

(2) of high specific surface area . . .

The greater porosity of reticular beads results in the reticular beads having a higher surface area relative to gel beads. Whereas gel beads have an internal surface area in the dry state of about 0.02 square meters per gram, reticular beads can have surface areas ranging from 1.0 square meter per gram to more than 800 square meters per gram. Albright, Tr. 100-103. Thus, the Court interprets "high specific surface area" to mean a surface area significantly greater than the corresponding gel bead made in the absence of the critical amount of liquid precipitant.

(3) The copolymer bead produced by this process has a controlled reduced apparent density of at least about 0.02 density units less than the apparent density of gel-type copolymer bead of the same composition made in absence of the liquid precipitant.

Claim 1 also teaches that the reticular bead made by this process possesses an apparent density of at least about 0.02 density units less than the corresponding gel resin. Gel resins typically have apparent densities around 1.050 grams per milliliter. As an example, the inventors note that a styrene-divinylbenzene bead containing 20% divinylbenzene prepared without the precipitant had a density of 1.047 grams per milliliter, whereas those prepared in accordance with claim one had a density of 0.866 grams per milliliter. PX 2011, col. 10, ll. 20-46.

(4) Dissolving in a liquid (precipitant) (1) a polyvinylidene monomer containing a plurality of ethylenically unsaturated groups in non-conjugated relationship and (2) a monovinyl aromatic hydrocarbon monomer.

The process disclosed by Claim 1 teaches one skilled in the art to dissolve in a liquid precipitant (to be defined below) two monomers. One of the monomers should be a polyvinylidene monomer. The specification sets out suitable polyvinylidene compounds as well as "particularly preferred polyvinylidene monomers." The preferred polyvinyl compounds are those known as crosslinkers, and include divinylbenzene. The polyvinylidene monomers function as crosslinking agents by connecting two linear polymer chains together.

The second monomer dissolved in the liquid is a monovinyl aromatic hydrocarbon. Once again the specification details suitable monovinyl compounds. The most commonly used monovinyl compound used in the ion exchange resin industry is styrene. Albright, Tr. at 169.

(5) The liquid precipitant (a) has a low solubility in the aqueous medium, (b) is a solvent for the monomer mixture and (c) does not appreciably swell the forming copolymer

As stated above, the process in Claim 1 teaches one skilled in the art to dissolve the mixture of the two monomers in a liquid precipitant, or a mixture of liquid precipitants. Claim 1 places four limits on the precipitant. First, the precipitant must have a low solubility in the suspending medium. Because suspension polymerization of the type disclosed in the present invention is most commonly conducted in water, it is the water-solubility of the precipitant that is of primary concern.

Second, the precipitant must be a solvent for the monomer mixture. Stated more simply, the precipitant must form a

homogenous solution with the monomer mixture and initiator. Albright, Tr. at 113.

Third, the precipitant must be incapable of exerting solvent action on the formed copolymer. A crosslinked polymer is generally insoluble, but it will absorb certain liquids which might be called good solvents. The precipitant must have essentially no solvent action on the polymer that is formed; or stated another way, will not swell the cross-linked polymer.

Finally, the precipitant must be chemically inert. It is necessary that the precipitant does not get involved or interfere with the polymerization taking place. Albright, Tr. at 114.

Brotech argues that "liquid precipitant" as used in Claim 1 is further limited to low molecular weight, non-polymer precipitants that are highly volatile. First, Brotech argues that the specification is limited to low molecular weight precipitants. All of the examples found in the specification use low molecular weight precipitants. The only mention of a polymer as a precipitant is where Dr. Abrams' patent is discussed and distinguished.

Second, Brotech argues that the prosecution history indicates that the patents-in-suit do not cover high molecular weight precipitants. Specifically, Brotech cites Rohm and Haas' early belief that toluene was not a precipitant within the meaning of the patents because of its ability to swell the copolymer at low levels of cross-linking.

Finally, Brotech argues that Mr. Oline's lack of success in producing macroreticular copolymer beads using certain high molecular weight precipitants, such as toluene and stenyl, demonstrates that the patents are limited to low molecular weight precipitants.

While the actual examples all use low molecular weight liquid precipitants, the specification expressly states that there is no universal or single class of suitable precipitants. The specification also states that the "chemical character of the precipitant may vary appreciably." PX 2011, col. 8, ll. 59-61 (emphasis added). Finally, the patent specification defines "precipitant" only by the function it performs, i.e. it is a solvent for the monomers and a non-swelling agent for the forming copolymer. The specification states that "[a]ny liquids which are solvents for the monomer mixture and which give negligible swelling of the copolymer will function as precipitants."

Although patent claims are to be interpreted in light of the specification, everything expressed in the specifications does not need to be read into the claims. SRI Int'l v. Matsushita Elec. Corp. of America, 775 F.2d 1107, 1118-21 (Fed. Cir. 1985); E.I. DuPont de Nemours & Co. v. Phillips Petroleum Co., 849 F.2d at 1433; Specialty Composites v. Cabot Corp., 845 F.2d 981, 986-88 (Fed. Cir. 1988) (even though examples in specification used only external plasticizers, court did not interpret the word "plasticizer" in claim to exclude internal plasticizers). Certainly, the absence in the specification of any mention of high

molecular weight precipitants, and Rohm and Haas' unsuccessful early attempts to produce macroreticular products using high molecular weight precipitants is relevant to the scope of what the inventors intended to claim by the use of "liquid precipitant." However, it is not sufficient to convince the Court that the inventors were claiming only low molecular weight precipitants.

This is particularly true, where as here, the inventor offers a reasonable and credible explanation regarding the non-selection of high molecular weight materials. Mr. Oline explained that high molecular weight precipitants were not initially selected for experimentation due to the fact that low molecular weight precipitants were more readily available and were easier to remove at the completion of polymerization. In addition, Mr. Oline explained that there was incredible time pressure to complete experimentation due to Rohm and Haas' decision to begin on the development of a plant process within months of Meitzner and Oline's discovery. The unsuccessful experiments referred to above were conducted as last minute thoughts just prior to a temporary hold on research while the plant process was being developed. Mr. Oline stated that he did not explore the possibility of using these high molecular weight precipitants to the same degree as earlier experiments with low molecular weight precipitants.

Brotech also urges the Court to read the limitation that the precipitant should be of certain volatility into Claim 1. Again the Court does not find support in the patent specification or file wrapper for this limitation. The patent specifically

addresses the use of precipitants with a wide range of volatilities in setting forth various methods of removing the precipitant from the beads. The fact that precipitants of high volatility may be preferred due to their ease of removal or recovery does not justify reading it into a claim as a limitation.

(6) Copolymerizing the two monomers while suspended.

Claim 1 next teaches that the two monomers are copolymerized in an aqueous medium using the known technique of suspension polymerization. Suspension polymerization was well-known by those skilled in the art prior to Meitzner and Oline's discoveries. It involves suspending liquid droplets containing two monomers and an initiator in an aqueous medium in which the monomer mixture is substantially insoluble. The medium is then agitated dispersing the monomer mixture into fine droplets. The mixture is then heated, which causes the initiator to become thermally unstable and forms a radical. The free radical attacks the monomer. The monomer radical that develops attacks another monomer, until polymerization is complete. Albright, Tr. at 68-69.

(7) Liquid precipitant and polyvinylidene monomer each being present in an amount exceeding the critical concentration of each needed for phase separation of the copolymer from the monomer phase as the copolymer is formed.

Claim 1 teaches that there is a minimum concentration of liquid precipitant and the polyvinylidene monomer which must be present before phase separation will occur. The critical concentration limitation is that amount of precipitant and cross-linker above which phase separation will result. Without the

precipitant and cross-linker present in an amount above the critical concentration, no phase separation occurs and the desirable properties of the intended product, such as higher resilience and faster adsorption rates, are not obtained.

Adding the precipitant to the monomer phase causes the solubility of the monomer phase in copolymer form to decrease. Thus, the copolymer separates from the monomer phase as it is formed. As the concentration of monomer in the precipitating mass decreases due to polymerization, the solubility of the growing polymer becomes even less and the copolymer squeezes out the monomer solvent. This is the phenomena known as phase separation.

Dr. Albright defined phase separation as "the reaching of a state where the growing polymer becomes immiscible or insoluble in the monomer precipitant liquid phase and precipitates out, becomes a second phase or second entity." Albright, Tr. at 89. This phase separation occurs within the individual droplets that are formed by agitating the aqueous medium in the suspension polymerization process.

The patent specification teaches that the critical concentration of precipitant will vary depending on a number of factors, such as the nature of precipitant, and the type and amount of cross-linker used. In addition, Dr. Albright testified that other factors will also affect the minimum concentration of

precipitant needed, such as the temperature at which the polymerization is conducted, and the rate of polymerization.[7]

(8) After copolymerization, the copolymer beads so formed must be recovered from the suspension medium.

Finally, Claim 1 teaches that the copolymer beads must be recovered from the suspension medium. The invention is not limited to any particular method of recovering the copolymer beads. Rather, as articulated in the specification, the inventors recognized that the best method in recovering the beads would vary according to the properties of the specific precipitant used.

b. Literal Infringement

(1) Reticular cross-linked copolymer beads . . .

After reviewing a series of photomicrographs, including surface SEM's, interior SEM's, and a TEM at three magnifications, Dr. Albright concluded that all of Brotech's products photographed in Exhibits 2476-2516 are macroreticular and fall under the invention of the Meitzner-Oline patents. Albright, Tr. 183-84. Dr. Albright explained that his conclusion was based on the fact that the polymer particles pictured in the photographs tend toward physical symmetry whereas the holes are irregular. According to Dr. Albright, this is indicative of phase separation. Albright, Tr. at 185. Having viewed the photographs and listened to the experts of both sides with regard to what the photographs

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7. Dr. Albright also testified that the nature of initiator and dispersant can also have effect on the minimum concentration of precipitant needed to effect phase separation. Dr. Abrams and Laurie Golden disagree with Dr. Albright on this point, as is discussed below.

demonstrate, the Court credits the testimony of Dr. Albright. The Court is able to see clear indications of the solid portions of the beads tending towards spherical symmetry, with the gaps being more irregular.

(2) of high specific surface area . . .

With regard to surface area limitation, Dr. Albright testified that the Brotech products all "have a much higher surface area than the gels. It is not easy to extract surface area from an electromicrograph, but you can measure the domain size of the micro gel and, making some assumptions, you can calculate what those surface areas are. And in this case they are all larger -- much, much larger than corresponding gel polymers would be." Albright, Tr. at 186. Dr. Albright's testimony regarding the high specific surface area of Brotech's products is supported by PX-2061, which is an article written by J.J. Wolff.[8] Page 51 of that article is a table which lists the specific surface areas of four of the accused infringing products of Brotech: C150, A500, A500P, and A501P. The surface areas range from 5 to 30 meters squared per gram. This is much greater than the corresponding gel resin. Moreover, in his deposition on February 23, 1991, Mr. Golden testified that the specific surface area for A501P is 5-10 square meters per gram. This surface area is also significantly greater

8. J.J. Wolff worked for the French division of Purolite at the time he wrote this article. The data appearing in this table was reviewed and corrected by Laurie Golden prior to publication. See PX-2250 (deposition of J.J. Wolff), PX-2251 and PX-2252 (communications between Mr. Wolff and Mr. Golden regarding the data presented in this table).

than the gel resin surface area. Accordingly, the Court finds that Brotech's accused products possess high specific surface areas.

(3) The copolymer bead produced by this process has a controlled reduced apparent density of at least about 0.02 density units less than the apparent density of gel-type copolymer bead of the same composition made in absence of the liquid precipitant.

As Dr. Albright and Dr. Abrams testified, gel resins made from styrene and divinylbenzene possess an apparent density of approximately 1.047 to 1.050 grams per milliliter. Thus, in order to satisfy this limitation, Rohm and Haas must establish that the accused products have apparent densities of approximately 1.02 grams per milliliter or less. A review of the evidence in this regard compels the Court to conclude that Rohm and Haas has failed to carry its burden of proving that the accused product resins have a reduced apparent density of at least 0.02 density units less than the apparent density of the gel-type copolymer bead of the same composition when made in the absence of the liquid precipitant.

Rohm and Haas points to the following evidence as proving that this limitation is satisfied by the accused products:

First, Rohm and Haas cites to the December 13, 1990, deposition testimony of Don Brodie, Brotech's Rule 30(b)(6) witness. During this deposition, Don Brodie was asked the following question:

> We have discussed various of the macroporous products of Brotech and Purolite and at least in broad brush we've talked about the processes that are used. What I would ask you to do, Mr. Brodie, is to read to yourself claim one and tell me when you come to a term, if you do, which you feel does not accurately

> describe the process that Brotech or Purolite use to make their macroporous beads.

After some discussion off the record, Mr. Brodie identified "liquid precipitant." The following exchange then took place.

> Q. Is that the only term?
> A. There's no point in reading any further, because this is what the whole crux is about, so there's no point in going further.
> Q. I will ask you to go further and to identify for me any and all other terms in claim one which you believe do not accurately describe the Purolite processes.
> A. Amount exceeding critical concentration of "H" needed for phase separation.
> Q. Any others sir?
> A. I think there are other, but I'm -- not without talking to some of our research people.

Rohm and Haas asserts that Don Brodie admitted, by negative inference, that all other limitations found in the Claims of the '124 patent were present in Brotech's accused products. The Court does not agree. Don Brodie expressly stated that there were probably other limitations that were not satisfied that he could not identify.

Second, Rohm and Haas cites Mr. Brodie's testimony regarding Claim 2 of the '840 patent and Brotech's cation exchange resins. Mr. Brodie was asked the following question:

> Let me ask you to go to claim two, still with the '840 patent, and looking at the additional statement here [the statement that the apparent density of the beads is not greater than 1.0 grams per ml.], does that apply to the Purolite cation exchange resins that we have been discussing?

Mr. Brodie responded, "My basic problem with the statement is that it's so open it almost encompasses every polymer, whether it be in

your patent or not, made on the face of this earth. I think that's too general a statement to answer." The following exchange then took place:

> Q. That's not the question.
> MR. ROSEN: If that is true, it has to encompass your bead is the answer.
> MR. HUTZ: I don't know . . .
> MR. ROSEN: Is the answer to the question yes?
> THE WITNESS: Yes.

Rohm and Haas argues that when you compare this admission with Dr. Albright's testimony that standard styrene-divinylbenzene gel copolymers have an apparent density of 1.047 grams per milliliter, it is clear that the accused products satisfy the reduced apparent density limitation.

Finally, Rohm and Haas cites Dr. Albright's Affidavit, PX-2429, wherein Dr. Albright concluded:

> From my examination of these Purolite products and from the publicly available literature describing these products in terms of monomers used and functionalization, I conclude that they are within the literal terms of at least the following claims:
> Purolite A-500, A-501P: claims 1,4,8,9,10 of the '124 patent
> C-150, S-950: claims 1,4,8,9 of the '124 patent.

After reviewing this evidence, the Court is convinced that Rohm and Haas has failed to carry its burden of proving that the accused products possess reduced apparent densities as required by this element. First, Dr. Albright's blanket statement that certain accused products infringe claim 1 of the '124 patent is of little value absent some underlying support specific to reduced apparent density.

Second, as with Rohm and Haas' first deposition citation, the Court is unwilling to accord Don Brodie's purported admission the weight sufficient to sustain Rohm and Haas' burden. The exchange is muddled and subject to misinterpretation. The Court is unwilling to support an infringement finding on a vague and contrived admission.

Finally, Rohm and Haas' argument that Golden and Brodie did not enumerate this element as one that was inconsistent with the accused products, and thereby admitted that the accused products satisfy this element is nothing more than an attempt by Rohm and Haas to convolute its burden of proof. Rohm and Haas had the burden of proving infringement by a preponderance of the evidence. It cannot meet this burden by asking Brotech to disprove those elements Brotech believes are not met.

> **(4) Dissolving in a liquid (precipitant) (1) a polyvinylidene monomer containing a plurality of ethylenically unsaturated groups in non-conjugated relationship and (2) a monovinyl aromatic hydrocarbon monomer.**
>
> **(6) Copolymerizing the two monomers while suspended.**

There is little dispute that the Brotech accused products satisfy these elements of the Meitzner-Oline invention. Brotech stipulated that all of its macroporous resins are made by suspension polymerization of styrene and divinylbenzene in an aqueous medium.[9] Dr. Albright testified, and the patent

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9. The stipulation reads as follows: "All of the Brotech/PIL macroporous resins identified in Stipulations 5.1 to 5.4, except C-106, C-106NA and C-106E, use in their process of manufacture (continued...)

specification supports his testimony that divinylbenzene is a polyvinylidene monomer. Albright, Tr. at 170; PX-2011, col. 7, ll. 48. Dr. Albright likewise testified that styrene is a monovinyl hydrocarbon monomer. Albright, Tr. at 170. This testimony was not contested by Brotech. Accordingly, the Court finds that each of the accused Brotech products identified as being produced from styrene and divinylbenzene monomers satisfy these limitations.

(5) The liquid precipitant (a) has a low solubility in the aqueous medium, (b) is a solvent for the monomer mixture and (c) does not appreciably swell the forming copolymer

Brotech acknowledges that the accused products are made by adding either Breox,[10] Breox and isobutyl alcohol, or Breox and toluene to the suspension polymerization of styrene and divinylbenzene. Mr. Golden further acknowledged that Breox is an organic liquid, while Breox and isobutyl alcohol, and Breox and toluene together are mixtures of organic liquids. Dr. Albright testified that Breox, mixtures of Breox and isobutyl alcohol, and

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9. (...continued)
unfunctionalized beads made by suspension polymerization of a monomer mixture of styrene and divinylbenzene in an aqueous medium." D.I. 597, p. 19, at ¶5.9.

10. Breox is manufactured by the British Petroleum Corporation. Breox is a trade name of a polyalkylene glycol (PAG) with a molecular weight of about 4,600 daltons. Ucon and Pluracol are equivalent substances made by Union Carbide and BASF, respectively. For ease of reference, the Court will refer only to Breox, understanding that the Court's statement would apply equally to Ucon and Pluracol.

mixtures of Breox and toluene have low solubilities in the aqueous medium,[11] and are solvents for the monomer mixture.

However, while Dr. Albright, in his affidavit testified generally concerning Breox being unable to appreciably swell the styrene-divinylbenzene copolymer, Rohm and Haas introduced no evidence that Breox combined with toluene, or Breox combined with isobutyl alcohol would not appreciably swell the copolymer. This is a particularly troublesome omission in light of the testimony that toluene has been known to swell styrene-divinylbenzene copolymers. The Court is not persuaded by Rohm and Haas' reliance on the much discussed admission of Don Brodie. Having failed to provide any evidence to establish that mixtures of Breox and toluene and Breox and isobutyl alcohol would be unable to substantially swell the copolymer, the Court finds that Rohm and Haas has failed to prove that this limitation of the Meitzner-Oline invention is met by those products designated by Brotech as made by using Breox and isobutyl alcohol and Breox and toluene. "It is well settled that each element of a claim is material and essential, and that in order for a court to find infringement, the plaintiff must show the presence of every element or its substantial equivalent in the accused [product]." Lemelson v. United States, 752 F.2d 1538, 1551 (Fed. Cir. 1985).

Brotech further contends that Breox is not covered by the patents-in-suit because Breox is not a liquid precipitant within

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11. See also Brotech's Response to Request for Admission No. 13, PX-2225, pp. 4-5.

the meaning of the patents. First, Brotech argues that Breox is a high molecular weight linear polymer, as opposed to the low molecular weight precipitants described in the specification of the Meitzner-Oline patents. Second, Brotech argues that Breox results in larger and differently shaped pores than those produced under the Meitzner-Oline patent. Third, Brotech argues that Breox must be actively removed from the finished copolymer in a separate washing step. Fourth, the amount of Breox required to cause phase separation is substantially lower compared to the amounts of precipitants required to cause phase separation as disclosed by Meitzner-Oline. Finally, the level of Breox required to cause phase separation is essentially constant as decreasing amounts of crosslinker are used, i.e. no inverse relationship is required.

As interpreted by the Court, as long as the liquid meets the functional requirements set forth above, it falls within the Meitzner-Oline patent as a liquid precipitant. The Court does not find it significant that the pores produced using Breox are much larger than those using the precipitants in the examples of the patents.

With regard to the amount of Breox needed to cause phase separation, the patent specification expressly states that this number will vary depending upon the type of precipitant and the amount of cross-linker used. Therefore, the fact that the critical amount of Breox is lower than the critical amounts of other precipitants does not remove Breox from the claims of the '124 patent.

Finally, the Court declines to read into the claim a limitation regarding inverse-relationship which Brotech derived from one table found in the patent that discusses one type of precipitant. Claim 1 is not limited to liquid precipitants which have an inverse relationship with the amount of cross-linker used. Therefore, the fact that Breox does not possess this relationship does not remove it from the scope of the patents.

(7) Liquid precipitant and polyvinylidene monomer each being present in an amount exceeding the critical concentration of each needed for phase separation of the copolymer from the monomer phase as the copolymer is formed.

Dr. Albright testified, and Mr. Golden and Mr. Brodie conceded, that the accused macroporous beads are macroporous due to phase separation of the copolymer from the monomers inside the monomer droplet that occurs during the polymerization of styrene and divinylbenzene. Furthermore, Mr. Golden acknowledged that this phase separation was caused by the presence of Breox, or Breox with isobutyl alcohol, or Breox with toluene in the monomer mixture.

(8) After copolymerization, the copolymer beads so formed must be recovered from the suspension medium.

During his deposition, and again at trial Mr. Golden reviewed the process used by Brotech and Purolite to make macroporous beads. As described by Mr. Golden, once polymerization is complete, the beads are washed with a solvent for Breox, or distilled (to remove the isobutyl alcohol) and then washed with a solvent for Breox prior to functionalization. The Court finds that the process as described by Mr. Golden satisfies the limitation

found in claim 1 that the copolymer beads are recovered from the suspension medium.

In sum, the Court finds that the accused Brotech products satisfy all of the limitations of Claim 1 with the exception of the reduced apparent density limitation, and the swelling characteristics of mixtures of Breox and toluene and Breox and isobutyl alcohol. However, literal infringement requires that each and every limitation be met by the accused infringing product. Therefore, the Court concludes that the designated Brotech products do not infringe Claim 1 of the '124 patent.

2. Claim 4

Rohm and Haas also alleges that Brotech is literally infringing Claim 4 of the '124 patent. Claim 4 states in full: "The process of Claim 1 wherein the polyvinylidene monomer is divinylbenzene and the monovinyl monomer is styrene." Claim 4 is dependent on Claim 1. It further restricts Claim 1 by requiring that styrene and divinylbenzene be used as the monomers.

Brotech admits that its copolymers are made from styrene and divinylbenzene. Therefore, the accused products satisfy the additional limitation found in Claim 4. However, because the Court concluded that Rohm and Haas failed to meet its burden of proving literal infringement of Claim 1, the Court must also conclude that Brotech is not literally infringing Claim 4 of the '124 patent.

3. Claim 8

Claim 8 reads in full: "A reticular crosslinked copolymer prepared by the process of claim 1." Thus, Claim 8 is

directed to the copolymers themselves prepared by the process of Claim 1. Rohm and Haas has not proven that Brotech's accused products are produced according to the limitations present in Claim 1. As Claim 8 is a product-by-process claim limited to the process set forth in Claim 1, the Court concludes that Rohm and Haas has likewise failed to prove that the accused products infringe Claim 8.

4. Claim 9

Claim 9 reads as follows:

> A process for preparing ion exchange resin beads of high specific surface and reduced apparent density of at least about 0.02 density units less than that of gel-type copolymer beads of the same composition made in the absence of a precipitant, which comprises suspension copolymerizing in an aqueous medium (1) a polyvinylidene monomer containing a plurality of ethylenically unsaturated groups in non-conjugated relationship and (2) a monovinyl aromatic hydrocarbon monomer in a liquid precipitant which (a) has low solubility in the aqueous medium, (b) is a solvent for the monomer mixture and (c) does not swell the copolymer resulting from said copolymerization, said liquid precipitant and said polyvinylidene monomer being present in an amount exceeding the critical concentration of each needed for phase separation of the copolymer from the monomer phase as the copolymer is formed, and proportional to the reduction in apparent density desired, as compared to gel copolymer beads of the same composition, recovering the copolymer beads so formed and reacting the same to attach an ion exchange functional group to the copolymer beads.

Claim 9 teaches the same process as Claim 1 with one additional limitation; Claim 9 adds the additional process step of attaching an ion exchange functional group to the formed copolymer beads.

Brotech admits that its accused products have functional groups attached to copolymer beads. Thus, the accused Brotech products satisfy the additional limitation of Claim 9. However, for the same reason that the Court concluded that Brotech is not infringing Claim 1, the Court also concludes that Brotech is not literally infringing Claim 9 of the '124 patent.

5. Claim 10

Claim 10 reads as follows: "The process of claim 9 wherein the copolymer is functionalized with an ion exchange group." Claim 10, which is dependent on Claim 9, further limits the invention to anion exchange copolymer beads. Brotech's products are sold as anion exchange resins satisfy this additional limitation. However, because Claim 10 is dependent on Claim 9, and the Court has concluded that Claim 9 is not infringed, the Court also concludes that Claim 10 is not infringed.

B. The '840 Patent

The '840 patent was issued to Dr. Meitzner and Mr. Oline on March 17, 1981. The claims in the '840 patent describe macroreticular cation ion exchange resins and the methods of fabricating them. Rohm and Haas has asserted that Brotech's products and processes literally infringe Claims 1, 2, and 6 of the '840 patent.

1. Claim 1

Claim 1 of the '840 patent reads as follows:

> Cation exchange resin beads of macroreticular structure, high surface area, and lowered apparent density crosslinking essentially of a macroreticular crosslinked

copolymer matrix with cation exchange functional groups bonded thereto, said resin beads having (1) an apparent density of at least 0.02 density units less than, and (2) a surface area much greater than gel-type ion exchange beads of the same composition, said beads resulting from the presence therein of microscopic channels or voids of much larger dimensions than the micropores of gel-type ion exchange beads of the same composition, and which crosslinked copolymer matrix is prepared by copolymerizing a mixture consisting essentially of (i) a monovinyl carbocyclic aromatic compound or an ester of an acrylic or methacrylic acid, with (ii) a polyethylenically unsaturated monomer selected from the group consisting of a polyvinyl carbocyclic aromatic compound, an ester of a dihydric alcohol and an α-β-ethylenically unsaturated carboxylic acid, diallyl maleate, and divinyl ketone, the copolymerization being conducted while the monomers are dissolved in a phase separating amount of an organic liquid or a mixture of organic liquids which is a solvent for said monomers but which is unable to substantially swell the copolymers resulting from copolymerization.

Claim 1 discloses:

(1) Beads which are
(a) macroreticular

(b) an apparent density of at least 0.02 density units less than gel-type ion exchange beads of the same composition,

(c) a surface area much greater than gel-type ion exchange beads of the same composition, and

(d) microscopic channels or voids of much larger dimensions than the micropores of gel-type ion exchange beads of the same composition.

(2) The macroreticular beads are formed by dissolving in a liquid (precipitant) and copolymerizing (1) a monovinyl carbocyclic aromatic compound or an ester of an acrylic or methacrylic acid, and (2) a polyethylenically unsaturated monomer selected from the group

consisting of a polyvinyl carbocyclic aromatic compound, an ester of a dihydric alcohol and an α-β-ethylenically unsaturated carboxylic acid, diallyl maleate, and divinyl ketone.

(3) The precipitant is (a) an organic liquid or mixture of organic liquids which (b) is a solvent for said monomers, and (c) is unable to substantially swell the forming copolymers.

(4) The organic liquid must be present in an amount sufficient to effect phase separation.

(5) Functionalized as cation exchange resins.

The Court finds that these limitations are the same as the limitations found in Claim 1 of the '124 patent with the exception of element "(2)" and element "(5)." Therefore, to the extent that Rohm and Haas has proven that Brotech's accused products and processes satisfy Claim 1 of the '124 patent, Rohm and Haas has proven that they satisfy the similar claims found in the '840 patent. However, as with the '124 patent, the Court concludes that Brotech has not infringed the '840 patent because Rohm and Haas did not prove by a preponderance of the evidence that Brotech's accused products have a reduced apparent density of at least about 0.02 density units less than the corresponding gel bead.

While element "(2)" provides for a different class of precipitants than that described in the '124 patent, Dr. Albright testified that styrene is "a monovinyl carbocyclic aromatic compound or an ester of an acrylic or methacrylic acid" and divinylbenzene is a "polyethylenically unsaturated monomer selected from the group consisting of a polyvinyl carbocyclic aromatic

compound, an ester of a dihydric alcohol and an α-β-ethylenically unsaturated carboxylic acid, diallyl maleate, and divinyl ketone."

With regard to element "(5)," Brotech concedes that some of its accused products are functionalized with anion exchange groups so as to function as cation exchange resins.

2. Claim 2

Claim 2 reads as follows: "Cation exchange beads of claim 1 wherein the apparent density of the resin beads is not greater than 1.0 g/ml." Rohm and Haas relies on the purported admissions of Don Brodie as proof that Brotech's accused cation resins have densities not greater than 1.0 g/ml. However, as the Court stated above, if this can be read as an admission at all, it is not the sort of clear admission that is sufficient to carry Rohm and Haas' burden of proving infringement by a preponderance of the evidence.

3. Claim 6

Claim 6 is dependent on Claim 4. Claim 4 reads as follows:

> In a process for preparing a cation exchange resin have a water insoluble matrix and cation exchange groups bonded thereto, the improvement comprising employing as said matrix a solid copolymer of macroreticular structure which is permeated by small channels or voids into which liquids are able to penetrate, consisting essentially of (1) a monovinyl carbocyclic aromatic compound or an ester of an acrylic or methacrylic acid, with (2) a polyethylenically unsaturated vinyl carbocyclic aromatic compound, an ester of a dihydric alcohol and an α-β-ethylenically unsaturated carboxylic acid, diallyl maleate, and divinyl ketone, the copolymerization being conducted while the monomers are dissolved in

> a phase separating amount of an organic liquid or mixture of organic liquids which is a solvent for said monomers but which is unable to substantially swell the copolymers resulting from copolymerization.

Claim 4 adds no new elements to those already interpreted by the Court with the exception of the monomer groups. Dr. Albright testified that styrene is a species of monovinyl carbocyclic aromatic compound. Albright, Tr. at 170. He further testified that divinylbenzene is a particular species of polyethylenically unsaturated monomer. Albright, Tr. at 170. However, as with the above claims, Rohm and Haas has not met its burden of proving that the mixtures of Breox and isobutyl alcohol and the mixtures of Breox and toluene are unable to substantially swell the resulting copolymer.

Claim 6 teaches the process disclosed in claim 4, with the additional limitation that the base copolymer be prepared by suspension polymerization. As all of Brotech's accused products are made using suspension polymerization, the Court finds that Brotech's products and processes meet the additional limitation of Claim 6. Nonetheless, the Court concludes that Brotech is not infringing Claim 6 because Claim 6 is dependent on Claim 4, and Rohm and Haas has failed to prove by a preponderance of the evidence that Brotech is infringing Claim 4 of the '840 patent.

C. The '415 patent

The '415 patent was issued to Dr. Meitzner and Mr. Oline on September 23, 1980. It claims macroreticular cation exchange resins and methods of making them. Plaintiff contends that

Brotech's products and manufacturing process described above infringe under the doctrine of equivalents, Claims 1, 2, and 5-12 of the '415 patent.

1. Claim Interpretation and Doctrine of Equivalents Analysis

Claim 1 of the '415 patent reads as follows:

> In a process for preparing a cation exchange resin having a water-insoluble matrix and cation exchange groups bonded thereto the improvement comprising employing said matrix a solid copolymer of macroreticular structure which is permeated by small channels or voids into which liquids are able to penetrate, which matrix is prepared by copolymerizing a mixture consisting essentially of (1) a monovinyl carbocyclic aromatic compound or an ester of acrylic or methacrylic acid, with (2) a polyethylenically unsaturated monomer selected from the group consisting of a polyvinyl carbocyclic aromatic compound, an ester of a dihydric alcohol and an α-β-ethylenically unsaturated carboxylic acid, diallyl maleate, and divinyl ketone; the aforesaid copolymerization being conducted while the monomers are dissolved in a 25 to 150% by weight, based on monomer weight, of an organic liquid or mixture of organic liquids which is a solvent for said monomers but is unable to substantially swell the copolymers resulting from copolymerization.

The elements of Claim 1 of the '415 patent are substantially identical to those found in the other product by process claims of the '124 patent and '840 patents. Therefore, the Court will discuss only those elements which are unique or need further explanation with regard to the '415 patent.

First, Claim 1 of the '415 patent is limited to cation exchange resins. With regard to this element, Brotech concedes that certain of its accused products are functionalized to perform

as cation exchange resins. Therefore, this element is satisfied by those products.

Second, Claim 1 of the '415 patent places a percentage limitation on the amount of liquid precipitant to be employed in the polymerization process; the amount specified in Claim 1 is 25 to 150% by weight, based on monomer weight. The evidence produced at trial demonstrates that Brotech's accused processes utilize less amounts of precipitant than specified by this limitation. Rohm and Haas acknowledges as much, which explains Rohm and Haas' assertion of liability for infringement based upon the doctrine of equivalents as opposed to literal infringement.

Infringement under the doctrine of equivalents occurs when the alleged infringer's product or process performs substantially the same function, in the same manner, to obtain substantially the same result as the claimed invention. Graver Tank & Mfg. Co., Inc. v. Linde Air Prods. Co., 339 U.S. 605, 608 (1950). Rohm and Haas contends that Brotech's accused processes and products infringe this claim under the doctrine of equivalents because the amount of precipitant utilized by Brotech is sufficient to cause phase separation and create macroreticular resins with agglomerates of gel microshperes. Thus according to Rohm and Haas, the use of Breox, although not within the literal language of Claim 1 of the '415 patent (because of the amount of Breox used), infringes under the doctrine of equivalents. First, Rohm and Haas argues that the lesser amount of Breox functions in the same manner as the precipitants disclosed in the '415 patent: Breox, alone or

in combination with isobutyl alcohol or toluene, causes phase separation of the growing copolymer chains, forming microgels which grow and agglomerate. Moreover, the same result is achieved, a phase separated macroreticular bead with a continuous gel and continuous pore phase.

Brotech counters that Breox does not function in the same way as the low molecular weight precipitants found in the examples of the '415 patent. First, Brotech notes that phase separation can be achieved with much smaller amounts of Breox. Second, Breox does not have an inverse relationship with the amount of cross-linker. Third, Breox is not easily removed from the copolymer bead. Finally, the pore shape and size of Brotech's products are different from those made according to the '415 patent.

The process claimed in Claim 1 and Brotech's process essentially differ in one respect; Brotech does not use 25 to 150% by monomer weight of precipitant to effect phase separation. Therefore, the question the Court must answer is this: given this difference, would Brotech's process (using a lesser amount of precipitant) and the claimed process using the 25-150% of precipitant perform substantially the same function (i.e., producing macroreticular copolymer beads) in substantially the same way (i.e. by adding a precipitant in a critical amount so that the forming copolymer precipitates out of the monomer solution, grows, and agglomerates) to give substantially the same result (i.e. phase separated, macroreticular beads).

The Court is not persuaded that Brotech infringes the '415 patent under the doctrine of equivalents. The Court finds that Brotech's process and result are different and are not substantially the same. The Court credits Brotech's arguments and finds that the two processes are not functionally equivalent because Brotech uses a different precipitant than that recited in the '415 patent. The Court finds that Breox is not described by the '415 patent. Breox has a molecular weight of 4600 versus the low molecular weight precipitants described in the '415 patent of 350. The resulting Brotech resin is significantly different in that the Breox sticks to the copolymer beads and its removal affects the shape and size of the pores. Even if both processes produce phase separated copolymers, the Court finds that Brotech's final cation exchange resin is different from that of Rohm and Haas.[12]

IV. INVALIDITY

Brotech has asserted several affirmative defenses with respect to the validity of the three patents at issue. Brotech contends that the Meitzner-Oline patents are invalid as anticipated or obvious over: (1) Abrams products and processes as described in U.S. Patent No. 3,122,514 issued to Dr. Abrams ("Abrams '514 patent), British Patent No. 785,157 issued to Dr. Abrams ("Abrams British patent"), Canadian Patent No. 625,989 issued to Dr. Abrams

12. The Court has reviewed Claims 2 and 5 through 12 for infringement under the doctrine of equivalents using a similar analysis and finds that Brotech does not infringe these claims.

(Abrams' Canadian patent"), article written by Dr. Abrams and published in 1956, "High Porosity Polystyrene Cation Exchange Resins," ("Abrams 1956 article"); (2) Corte process and products as described in Count 1 of the '816 Interference won by Corte, U.S. Patent No. 3,586,646 issued to Herbert Corte ("Corte '646 patent"), U.S. Patent No. 3,637,535 issued to Herbert Corte ("Corte '535 patent"); (3) Mindick process and products as described in U.S. Patent No. 3,549,562 issued to Morris Mindick ("Mindick patent"), and (4) IRC-50. Brotech further contends that the patents are invalid for interference estoppel.

Under 35 U.S.C. § 282, a patent is presumed valid, and Brotech has the burden of proving invalidity by clear and convincing evidence. American Hoist & Derrick Co. v. Sowa & Sons, Inc., 725 F.2d 1350, 1360 (Fed. Cir. 1984), cert. denied, 469 U.S. 821 (1984). This burden remains on the challenger of patent validity at all times, and the standard remains at all times clear and convincing. Jervis B. Webb Co. v. Southern Sys., Inc., 742 F.2d 1388, 1392 & n.4 (Fed. Cir. 1984).

A. The Assertion By Rohm and Haas of Prior Conception and Reduction to Practice

Rohm and Haas seeks to avoid the invalidity arguments of Brotech regarding Corte, Mindick, IRC-50, and the interference count by proving that Meitzner and Oline conceived and reduced to practice the invention prior to the effective dates of these alleged prior art references. Conception is defined by the Court of Appeals for the Federal Circuit as "'the formation, in the mind of the inventor of a definite and permanent idea of the complete

and operative invention, as it is thereafter to be applied in practice'." Coleman v. Dines, 754 F.2d 353, 359 (Fed. Cir. 1985) (quoting Gunter v. Stream, 573 F.2d 77, 80 (C.C.P.A. 1978)). The party claiming a pre-filing date of invention must show that every limitation of the count was known to the inventor at the time of the conception. To establish actual reduction to practice, the party must demonstrate that the claimed invention worked for its intended purpose. Hybritech Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987).

Rohm and Haas presented the following evidence related to the conception and reduction to practice of the patents in suit. First, Rohm and Haas presented an entry made by Dr. Meitzner in his Research Notebook. PX-2300. In this entry, Dr. Meitzner suggested the idea of an improved ion exchange resin formed by adding a diluent possessing a measured degree of hydrophilicity to the monomer system. According to this entry, the diluent would be compatible with the monomer system, while incompatible with the polymer being produced. Dr. Meitzner described that as the suspended droplets polymerized, phase separation might occur, resulting in opaque or translucent beads.

As Dr. Meitzner was unavailable to testify, Rohm and Haas admitted Dr. Meitzner's research notebook through the testimony of Mr. Oline and Dr. Kunin. Mr. Oline testified that Dr. Meitzner discussed his hypothesis with Mr. Oline shortly after January 31, 1957 and asked Mr. Oline to work with him in developing it. Oline,

Tr. at 343-44. Mr. Oline further testified that throughout February and March, he and his assistant, Mr. Sigafoos, unsuccessfully attempted to produce a phase separated resin using a number of different diluents.

On March 14, 1957, Mr. Sigafoos, at Mr. Oline's direction,[13] prepared styrene-DVB copolymer using 20% DVB by weight in the presence of 35% tertiary amyl alcohol. Mr. Sigafoos' notebook entries describe the resulting beads as milky white beads that floated. PX-2301.

Rohm and Haas also presented Mr. Sigafoos' notebook entries regarding the sulfonation of the copolymer. Mr. Sigafoos' notes indicate that sulfonation proceeded in two and a half hours, which was very rapid compared to gel resins. Mr. Sigafoos recorded that there was no significant bead shattering and the solids content was 48%. PX-2301. Mr. Oline testified that this indicated to him that a new copolymer, superior to conventional gel resins, had been formed. Oline, Tr. at 348, 355-57, 371, 386-87. Based on this evidence, Rohm and Haas asserts that Meitzner and Oline's invention of macroreticular cation exchange resins was reduced to practice by March 1957.

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13. Mr. Oline testified that after the initial unsuccessful attempts at producing a phase separated bead, Dr. Meitzner suggested to Mr. Oline to try any ideas Mr. Oline might have. Mr. Oline decided to try tertiary amyl alcohol. Mr. Oline selected tertiary amyl alcohol based on the fact that it possesses an unusual property known as reverse solubility--the solubility of tertiary amyl alcohol diminishes as the temperature of the solution is increased. Oline, Tr. at 352-53.

Brotech contends that Rohm and Haas has failed to establish a pre-filing conception and reduction to practice for two reasons.[14] First, Brotech argues that the only evidence relied upon by Rohm and Haas is the uncorroborated testimony of inventor Mr. Oline, and that this is insufficient to establish actual reduction to practice. Second, Brotech contends the evidence relied upon by Rohm and Haas did not prove that every limitation of the claimed invention was known to Dr. Meitzner at the time of the alleged conception.

It is now understood that to successfully employ the process of the Meitzner-Oline invention, one must use a minimum critical amount of precipitant. Further, the critical amount of precipitant will vary with the particular precipitant employed and with the amount of cross-linking agent in the monomer mixture. While the Court is persuaded by Rohm and Haas's evidence that Rohm and Haas produced a macroreticular resin by March 1957, what Rohm and Haas' evidence fails to establish is that Dr. Meitzner and Mr. Oline understood and recognized at that time that they achieved the desired result because they used a critical amount of precipitant, and how that critical amount of precipitant relates to the amount of crosslinker employed. This is a significant omission in light of Rohm and Haas' success in obtaining patents over Corte and Mindick by arguing that "There is no disclosure or suggestion in .

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14. Brotech preliminarily objects to any attempt by Rohm and Haas to prove a pre-filing date of invention based on Rohm and Haas's alleged discovery failures. The Court resolved this dispute above, concluding that Rohm and Haas is entitled to present evidence to establish a pre-filing date of invention.

. . Corte . . . of the need for using critical concentrations [of precipitant] . . . for producing phase separation," and that "Corte does not disclose the need for controlling both the crosslinker content and the amount of solvent in order to obtain phase separation."

Rohm and Haas has failed to prove that every limitation of the invention was known to Dr. Meitzner and Mr. Oline at the time of the conception, and therefore has failed to prove conception and reduction to practice that pre-dates the filing date of the patents.[15] Accordingly, the date of invention for purposes of determining the validity of the Meitzner-Oline patents over Brotech's anticipation and obviousness challenges will be presumed to be the filing date of the patents. All three patents originated from a single application, and thus, all are entitled to the filing date of the earlier application which is July 18, 1958.

B. Anticipation, § 102

Section 102 provides in pertinent part that one is entitled to a patent "unless . . . the invention was . . . described in a printed publication in this country . . . before the invention thereof by the applicant for patent, or . . . was described in a printed publication . . . more than one year prior to the date of the application for patent in the United States . . . ." To establish anticipation Brotech must prove that a prior art

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15. In concluding that Rohm and Haas is not entitled to rely on a pre-filing date of invention, the Court finds it unnecessary to address Brotech's contentions regarding the sufficiency of Rohm and Haas' evidence regarding reduction to practice.

reference available described the identical invention prior to the effective date of the invention. Mannesman Demag Corp. v. Engineered Metal Prods. Co., Inc., 605 F. Supp. 1362, 1367-68 (D. Del. 1985), aff'd, 793 F.2d 1229 (Fed. Cir. 1986); see also Diversitech Corp. v. Century Steps, Inc., 850 F.2d 675, 677 (Fed. Cir. 1988).[16] "[O]ne who seeks such a finding must show that each element of the claim in issue is found, either expressly described, or under principles of inherency, in a single prior art reference, or that the claimed invention was previously known or embodied in a single prior art device or practice." Kalman v. Kimberly-Clark Corp., 713 F.2d 760, 771 (Fed. Cir. 1983), cert. denied, 465 U.S. 1026 (1984).

Claim 1 of the '124 patent is representative of the claims found in all three patents. Although there are distinctions, they are not significant in terms of the Court's anticipation analysis. The Court has interpreted Claim 1 of the '124 patent as having the following limitations, or elements:

> (1) Reticular cross-linked copolymer beads
> (2) of high specific surface area,
> (3) And a controlled reduced apparent density of at least about 0.02 density units less than the apparent density of gel-type copolymer bead of the same composition made in absence of the liquid precipitant.
> (4) The copolymer is produced by dissolving in a liquid (precipitant) (1) a polyvinylidene monomer containing a plurality of ethylenically unsaturated groups in non-

16. A "printed publication" is a publication that is sufficiently accessible to members of the public who are interested in the art and exercise "reasonable diligence." In re Hall, 781 F.2d 897, 900 (Fed. Cir. 1986).

conjugated relationship and (2) a monovinyl aromatic hydrocarbon monomer.

(5) The liquid precipitant (a) has a low solubility in the aqueous medium, (b) is a solvent for the monomer mixture and (c) does not appreciably swell the forming copolymer

(6) Copolymerizing the two monomers while suspended.

(7) Liquid precipitant and polyvinylidene monomer each being present in an amount exceeding the critical concentration of each needed for phase separation of the copolymer from the monomer phase as the copolymer is formed.

(8) After copolymerization, the copolymer beads so formed must be recovered from the suspension medium.

In order to prove that Claim 1 of the '124 patent is invalid as anticipated by a prior art reference, Brotech must prove, by clear and convincing evidence, that each one of these limitations was disclosed in a single prior art reference. Id.

1. Abrams

Among the prior art references relied on by Brotech to support its assertions of invalidity are: Abrams British patent, Abrams Canadian patent, Abrams '514 patent, Abrams 1956 article, and a Duolite Data Leaflet for Duolite C-25, dated June 1954. Each of these references antedates the filing of the Meitzner-Oline patent application.

Prior to discussing invalidity with regard to the Abrams process and products, the Court notes that during the prosecution of the Meitzner-Oline application, Rohm and Haas cited to the PTO the Abrams British patent and Abrams 1956 article. Where, as here, the challenger relies on prior art which was considered by the PTO, the burden of proving invalidity becomes more difficult to overcome. This is because the one challenging the validity of the

patent has the added burden of overcoming the deference that the Court gives to the PTO validity determinations. Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve Inc., 796 F.2d 443, 447 (Fed. Cir. 1986), cert. denied, 484 U.S. 823 (1987); Polaroid Corp. v. Eastman Kodak Co., 789 F.2d 1556, 1560 (Fed. Cir.), cert. denied, 479 U.S. 850 (1986).

The Abrams process as disclosed in the '514 patent involves the suspension polymerization of styrene and divinylbenzene in the presence of linear polystyrene. The process involves prepolymerizing a "monovinyl aromatic monomer" or styrene to form linear polystyrene. The prepolymerized styrene is then polymerized with styrene and divinylbenzene. At the conclusion of the polymerization, the linear polystyrene is cast within the copolymer.

a. The Patents

The Court finds that none of the prior art references relied upon by Brotech with regard to the Abrams' process anticipate any of the claims of the Meitzner-Oline patents. First, the Abrams' process, as disclosed by the Abrams' patents, does not teach the formation of a macroporous copolymer bead prior to functionalization. Second, the two phases present in Dr. Abrams' resins are not formed as a result of phase separation due to the presence of a liquid precipitant. Third, none of the references teaches that Dr. Abrams' resins have a reduced apparent density of at least about 0.02 less than the gel bead of the same composition.

Although Dr. Abrams testified that precipitation and phase separation occur during the polymerization step of the Abrams' process, this testimony was overwhelmingly contradicted by Dr. Abrams' '514 patent, an article written by Dr. Abrams himself, a product brochure from Duolite regarding the Abrams' process and Rohm and Haas' expert, Dr. Svec. Dr. Abrams explains the opacity obtained in his resins in the specification of the '514 patent:

> The resins of this invention are relatively opaque compared to the translucent ion exchange resins of identical constituents prepared without first prepolymerizing the monovinyl compound. It is believed that the relative opaqueness is due to the presence of linear polymer in the structure, part of which washes out during the chemical processing necessary to introduce the ion exchange groups. This leaves a system of micro-channels and pores through which molecules diffuse more readily than in conventional ion exchangers.

This seems to indicate that prior to functionalization, there are not micro-channels or pores. This interpretation is consistent with what Dr. Abrams wrote in his 1967 article, "Ion Exchange Polymers" which appears in the Encyclopedia of Polymer Science and Technology. At page 701 of his article, Dr. Abrams states that macroporous or macroreticular resins can be made "either by incorporating a linear polymer within the monomer phase during polymerization ((15-17) [citing to Dr. Abrams' '514 patent, Abrams' 1956 article] or by precipitating polymer within the gel phase before polymerization is completed (18-21) [citing to Millar,) Meitzner-Oline]. Dr. Abrams describes the two methods in greater detail:

> [w]hen a linear polymer, such as polystyrene, is incorporated in the monomer mixture, polymerization occurs in the normal manner to give beads which exhibit high porosity on conversion to ion exchange resins. The residual linear polymer can be removed either by solvent extraction or by a subsequent reaction which converts the linear polymer to a water-soluble derivative. . . . On the other hand, the precipitant-solvent method requires a high proportion of divinylbenzene in the total monomer. . . . This results in two distinct phases, a pore phase and a gel phase.

(PX-2409).

In 1974, Duolite published a technical description of the commercial process for making C-25D, allegedly made according to the Abrams' process. The bulletin describes the Abrams' process generally as one in which "polystyrene is cast into the copolymer. On sulfonating the copolymer bead, the linear polystyrene is sulfonated and is removed for the most part during the subsequent processing steps, leaving the product porous." (PX-2407). The bulletin then describes in greater detail the sulfonation process, "the beads start sulfonating uniformly at the surface of the beads, eventually becoming translucent, and then opaque by the end of the reaction."

These descriptions of the Abrams process set out in very clear terms that the bead as initially copolymerized is not phase-separated and macroporous. The channels that form during the sulfonation step are not formed due to a precipitant causing phase separation during copolymerization; rather they are formed by dissolving residual linear polystyrene during the sulfonation step. This difference, coupled with the complete absence of any teachings

regarding apparent density of Abrams' resins (before and after functionalization), constrain the Court to conclude that the Abrams' process, as described in the three Abrams' patents does not anticipate the Meitzner-Oline inventions.

b. Abrams 1956 Article

Brotech also cites Abrams' 1956 article as an invalidating prior art reference. In Dr. Abrams' 1956 article, he reported that C-25 made with 16% divinylbenzene had a reduced specific gravity of 0.035 when compared to a 16% divinylbenzene gel bead. (DX-49, p. 1470). He also reported that sulfonation of C-25 proceeded rapidly with no apparent spalling and racking. Dr. Abrams wrote that he obtained a resin which differed from prior art resins in the nature of the porosity. He reported that the method used to make C-25 offered a means to make a resin with a high degree of porosity without lowering the degree of crosslinking.

Abrams' 1956 article does not add any teachings with regard to the Abrams' process beyond that which is disclosed by the Abrams' patents. As the Court found that the patents did not anticipate the Meitzner-Oline claims, the Court likewise finds that the Abrams' 1956 article does not anticipate any of the Meitzner-Oline claims.

2. Corte

The Corte application that led to the '535 patent was filed in the United States on March 5, 1958. The Corte application that eventually became the '646 patent was filed in the United States on April 8, 1958. As discussed above, the date of Meitzner-

Oline's invention is July 18, 1958, the date they filed their application in the PTO. See American Standard, Inc. v. Pfizer, Inc., 722 F. Supp. at 109. Therefore, both Corte '535 and Corte '646 are available as invalidating prior art references.

In order to prevail on its anticipation claim, Brotech was required to prove by clear and convincing evidence that every limitation in the relevant claims is found, "either expressly described, or under principles of inherency," in the Corte patents. Continental Can Co. USA, Inc. v. Monsanto Co., 948 F.2d 1264, 1267 (Fed. Cir. 1991). Moreover, as with the Abrams' references, the Corte inventions were before the PTO during the prosecution of the Meitzner-Oline patents.

Reading the Corte '535 and '646 patents for what they expressly, impliedly and inherently disclose, the Court finds that neither patent anticipates Claim 1 of the '124 patent as that claim has been interpreted by the Court. The Corte '535 patent does not read on at least three limitations of Claim 1 of the '124 patent.

First, there is no mention in the Corte '535 patent that the copolymers obtained by Corte's process are phase-separated and macroreticular as that term has been defined by the Court. The issue of whether Corte expressly or inherently disclosed that his beads were phase separated or macroreticular is the first of many issues in which the Court found itself amidst a crossfire of a battle of experts. At trial, Dr. Abrams, Brotech's expert, was asked to identify the properties of macroporous resins found in Corte '535. Dr. Abrams first noted that Corte described certain

deficiencies present in gel beads, such as slow exchange rates, and then stated that he discovered anion exchangers "which do not have the defects referred to above and simultaneously show a high exchange velocity." Col. 1, ll. 16-44. Dr. Abrams then quoted from Corte's specification where Corte describes his beads as opaque beads possessing a "sponge structure" that is "permeated by small veins, into which nonsolvents and nonswelling agents are also able to penetrate." Furthermore, Corte describes his anion exchangers as possessing "high genuine porosity, which can be recognized from the fact that the moist exchangers appear opaque or completely non-transparent." With regard to the disclosures contained in the Corte '535 specification, Dr. Abrams concluded, "That, to me, is a very good description of a macroporous phase-separated resin."

Dr. Abrams bolstered his opinion by referencing Corte's description of the color-absorbing power of his resins. At column 4 of his specification, Corte notes that "[w]ith increasing porosity, therefore, the color-absorbing power, i.e. the capacity more especially with respect to acids of high molecular weight, increases in spite of decreasing total capacity." With respect to Corte's findings with regard to the color absorbing power of Corte's resins, Dr. Abrams stated, "This is what we've been talking about. Macroporous resins are able to absorb large molecules more effectively than gel resins."

On the other hand, Dr. Svec, Rohm and Haas' witness, testified that "Corte does not suggest that he makes a

macroreticular polymer." Svec Tr., at 3318. When asked by Brotech's counsel whether there was anything in Corte that would lead Dr. Svec to the conclusion that Corte might have made a macroreticular copolymer, Dr. Svec replied, "No. There is not any single word about precipitation during polymerization. There is not a single word about the necessary reaching of thresholds for concentration of cross-linking agents and the precipitant, and so on." Svec Tr., at 3319.

After listening to the experts for both parties, and having the opportunity to view their demeanor and the forcefulness of their respective testimony, the Court finds the testimony of Rohm and Haas experts to be more credible on the issue of what Corte disclosed to one of ordinary skill in the art in 1958. The difficulty in determining whether one of ordinary skill in the art prior to the Meitzner-Oline invention would have understood Corte to disclose a macroreticular structure (as that term has been defined by the Court), is that once one becomes aware of the teaching of Meitzner-Oline, it is difficult to separate out hindsight. After listening to the experts, the Court is convinced that much of Dr. Abrams' testimony was premised not only on what he discovered subsequent to the Meitzner-Oline invention, but what Meitzner and Oline discovered as well.

The Corte patent fails to read on two additional limitations of Claim 1 of the '124 patent. There is no disclosure in Corte '535 that the beads produced according to the '535 patent have high specific surface area, or that the copolymers produced

according to his process have a controlled reduced apparent density of at least about 0.02 g/ml less than the apparent density of a corresponding gel bead of the same composition.

Even though Corte '535 does not expressly teach the surface area and controlled reduced apparent density limitations, Corte may still be found to anticipate Claim 1 of the '124 patent if the Court determines that Corte inherently achieves these results. Standard Havens Prods. v. Gencor Indus., 953 F.2d 1360, 1369 (Fed. Cir. 1991), cert. denied, 113 S.Ct. 60 (1992) ("An anticipatory reference, however, need not duplicate word for word what is in the claims. Anticipation can occur when a claimed limitation is 'inherent' or otherwise implicit in the relevant reference."). In Standard Havens, the Federal Circuit upheld a jury's anticipation finding, relying on testimony elicited at trial to conclude that an element not "expressly" taught in the invalidating reference was nonetheless present. Moreover, the missing characteristic (here, the surface area and density limitations) may be proven to be inherent by resort to extrinsic evidence. Continental Can Co. USA, Inc. v. Monsanto Co., 948 F.2d at 1268. "Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be recognized by persons of ordinary skill." Id.

> Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. [citations omitted.] If, however, the disclosure is sufficient to show that the

> natural result from the operation as taught would result in the performance of the questioned function, it seems to be well settled that the disclosure should be regarded as sufficient.

Id. at 1269 (quoting In re Oelrich, 666 F.2d 578, 581 (C.C.P.A. 1981)).

In an attempt to prove that Corte inherently teaches one skilled in the art how to produce a macroreticular copolymer bead with the density and surface area limitations found in the Meitzner-Oline patents, Brotech asked one of its scientists, Mr. Plant, to reproduce the examples set forth in Corte '535. Brotech also ran a number of in-house tests, in addition to sending the copolymers to outside laboratories for testing, to determine the porosity, surface areas, and densities of the copolymers made according to Corte Examples 1, 2, 3, and 4.

Rohm and Haas likewise attempted to reproduce Corte Examples 1, 2 and 3. Rohm and Haas, however, obtained clear beads. One explanation for the difference is Brotech and Rohm and Haas adopted different interpretations of the procedures spelled out in Corte Examples 2 and 3. It is not surprising that Brotech adopted the interpretation most likely to result in a phase separated copolymer, while Rohm and Haas adopted the interpretation least likely to result in a phase separated copolymer. All experts agreed that both interpretations were reasonable.

The Court finds that one skilled in the art following the Corte patent examples may produce a macroreticular structure. Even Rohm and Haas experts conceded this. This does not answer the

question of anticipation, however. The Court must determine, whether one of ordinary skill in the art practicing Corte would inevitably obtain a macroreticular bead with high specific surface area and reduced apparent density as described by Meitzner-Oline, and whether this person skilled in the art could do so without relying on teachings of the Meitzner-Oline patents. Columbia Broadcasting Sys. v. Sylvania Elec. Prods, Inc., 415 F.2d 719 (1st Cir. 1969), cert. denied, 396 U.S. 1061 (1970) (test for whether claimed invention has been anticipated is whether alleged prior anticipatory patent describes claimed invention with sufficient clarity and specificity so that one skilled in the art may practice the invention without assistance from the patent claimed to have been anticipated).

After listening to the experts on both sides, the Court is left with the inescapable conclusion that Corte did not inherently achieve resins with the required density and surface area limitations. If one practiced Corte using the critical amounts of precipitant and cross-linker, one would likely make a copolymer with high specific surface area and reduced apparent density of at least 0.02 less than the corresponding gel copolymer. However, it is the teaching of Meitzner-Oline that gives one the knowledge to use amounts of precipitant and cross-linker above the critical amounts. Thus, the Court finds that neither Corte patent anticipates the Meitzner-Oline claimed inventions.

3. Mindick[17]

Brotech also relies on U.S. Patent 3,549,562 issued to Mindick as a basis for invalidating the Meitzner-Oline patent. The Mindick patent issued from a continuation application of an application filed on October 22, 1957. As Mindick's filing date is approximately nine months earlier than the Meitzner date of invention, the Mindick patent is prior art for purposes of the Court's invalidity determinations.

The Mindick patent describes anion exchange resins with increased water-holding capacity and increased physical stability. Mindick discloses the use of toluene as precipitant in producing

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17. The original Meitzner-Oline application was involved in three separate interferences with the Mindick patent application. The first interference, No. 92,815 was declared on May 15, 1962. In addition to Mindick and Meitzner-Oline, the applications of Corte and Millar were also involved in the interference. This interference was dissolved prior to any finding of priority. DX-1.

The second interference, No. 96,314, was declared on March 29, 1969. It involved Mindick, Corte and Meitzner-Oline's applications. This interference was also dissolved, this time on the ground of interference estoppel for failure to raise matters which should have been litigated in the '815 interference. DX-4.

After the Mindick patent issued (December 22, 1970), Rohm and Haas provoked a third interference by copying claims 1-4 and 11-16 from the issued Mindick patent. Interference 97,787 was declared on October 21, 1971. DX-6. The Board of Interferences entered judgment for Mindick, ruling that Meitzner and Oline were estopped from asserting priority because they failed to contest priority in the '815 interference. In dictum the Board found that Meitzner and Oline conceived and actually reduced to practice the invention of counts 1-4 prior to October 22, 1957, but had not proven prior reduction to practice of the inventions in counts 5-10 prior to October 22, 1947.

On appeal, the Court of Customs and Patent Appeals affirmed the judgment of the Board on grounds of estoppel without reaching the question of actual priority. See Meitzner v. Mindick, 549 F.2d 775 (C.C.P.A.), cert. denied, 434 U.S. 854 (1977).

styrene-divinylbenzene copolymers. Brotech argues that the only difference between Mindick and Meitzner-Oline patents is the manner in which each describes the products made by the process. Brotech cites a long-standing principle in patent law that "when claimed compositions are not novel, they are not rendered patentable by recitation of properties, whether or not these properties are suggested or shown by the prior art." In re Spada, 911 F. 2d 705, 708 (Fed. Cir. 1990). The Court agrees that a mere recognition of that which is inherently disclosed in the prior art is not patentable. Verdegaal Bros., Inc. v. Union Oil Co. of California, 814 F.2d 628, 633 (Fed. Cir. 1987), cert. denied, 484 U.S. 827 (1987).

Once again, both parties provided expert testimony to support their respective positions. Dr. Abrams testified that one skilled in the art would have understood Mindick as teaching the production of macroreticular resins. In this regard, Dr. Abrams pointed out that data found in Mindick's patent demonstrated that Mindick was producing copolymers comprised of 16-40% divinylbenzene that possessed the same water-holding capacity as copolymers comprised of 1-4% divinylbenzene with no toluene added. Dr. Abrams noted that copolymers of 16-40% divinylbenzene made without the addition of a liquid like toluene would have much lower water-holding capacity. Thus, Dr. Abrams concluded that Mindick's production of styrene-divinylbenzene resins in the presence of toluene, with the properties Mindick discloses could only be explained by the presence of true pores, and would have been so

understood by one skilled in the art. Dr. Abrams also based his conclusion on Mindick's disclosures that (1) the resins made with the addition of toluene possessed physical stability superior to resins with the same water-holding capacity, and (2) his resins possessed increased porosity.

Dr. Abrams also specifically testified that each element of Claim 1 of the '124 patent was met by the Mindick patent. Dr. Abrams testified that the apparent density limitation is satisfied by reference to Examples 52 and 53 in the Mindick patent. As Mindick uses styrene and divinylbenzene as the monomers, limitation (4) of Claim 1 is met. Dr. Abrams testified that toluene acts as a precipitant, is a solvent for the monomer mixture and does not appreciably swell the styrene-divinylbenzene copolymer. Finally, Dr. Abrams testified that the preferred examples call for amounts of toluene and divinylbenzene that would result in a macroreticular copolymer, i.e. above the critical amounts. Abrams Tr., at 1209-1211, 2787-88

With regard to the other claims of the '124, '415 and '840 patent, Dr. Abrams applied his testimony regarding Claim 1 of the '124 patent. Abrams Tr., at 2788-2793. Claim 7 of the '415 patent requires that the added organic liquid (precipitant) be selected from the group consisting of an aliphatic alcohol and an aliphatic hydrocarbon. Dr. Abrams testified that toluene is an aliphatic hydrocarbon. Abrams Tr., at 2791.

Dr. Abrams testimony was largely based on an article written by J.R. Millar.[18] Dr. Abrams pointed out four parts of Millar's article which supported his conclusion that Examples 52, 53, and 58 of the Mindick patent will make macroreticular resins. First, Dr. Abrams pointed to Figure 6 found on page 221 of Millar's article. As explained by Dr. Abrams, Figure 6 is a plot of the divinylbenzene content against the monomer fraction of the mixture. The plot purports to delineate macroporous and non-macroporous resins. Dr. Abrams explained that Example 58 and Example 1 of Mindick would fall in the macroporous range, as macroporous is defined by the article.

Dr. Abrams also testified that Figure 3 of Millar's article supports his conclusion that Mindick made macroreticular resins. Figure 3 is a plot of swelling times versus the amount of divinylbenzene. It shows that a swelling time of Example 58, 40% divinylbenzene-50% toluene, is under two minutes, whereas the swelling time for a comparable gel resin would be about seven days. Abrams Tr., at 2801. Dr. Abrams testified that the resin has to be macroreticular/macroporous to fully swell that rapidly. Abrams Tr., at 2802.

Dr. Abrams also testified that Figure 4 supported his conclusions with regard to the disclosures of Mindick. Figure 4 is a plot of percent divinylbenzene versus apparent density. Figure

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18. The article is J.R. Millar, D.G. Smith, W.E. Marr, and T.R.E. Kressman, Solvent-Modified Polymer Networks. Part I. The Preparation and Characterization of Expanded-Network and Macroporous Styrene-Divinylbenzene Copolymers and Their Sulphonates, J. of Chem. Soc'y 218 (January 1963).

4 states that the apparent density of a gel resin made with 20% divinylbenzene is approximately 1.047 grams per milliliter; whereas the same resin made with an addition of 67% toluene has an apparent density of just above 1.0 grams per milliliter. Based on this, Dr. Abrams testified that Mindick Example 1, which calls for 65% toluene, would be macroporous.

Rohm and Haas' experts disagree with Dr. Abrams as to what Mindick disclosed to one of ordinary skill in the art in 1958. Dr. Albright notes that the patent is silent as to precipitation, phase separation, opacity, controlled reduced apparent density, and surface area. According to Dr. Albright, "There is no indication at all that [Mindick] was even seeking to get a new type of structure, to get a new internal system. He talked simply about porosity. As he is talking about porosity, he's basically relating it to gel porosity." Albright Tr., at 2686.

With regard to Mindick's disclosures relating water-holding capacity to porosity, Dr. Albright testified that the values for water-holding capacity Mindick obtained could be obtained with a gel resin. Albright Tr., at 2688. In addition, Dr. Albright testified that the water-holding capacities reported by Mindick were affected by the conditions under which Mindick chloromethylated his resins. According to Dr. Albright chloromethylating a polymer under "vigorous" conditions can result in a type of macroreticularity, apparently unrelated to that caused by precipitation and phase separation. Albright Tr., at 2689. Finally, as Dr. Albright noted, Mindick's reported data refers to

functionalized resins. Dr. Albright testified that the functional groups draw water into the polymer. Thus, the amount of functionality (undisclosed by Mindick) could have also affected his water-holding capacity data irrespective of the amount of porosity.

Notwithstanding what is missing from the expressed disclosures found in the Mindick patent, the patent may be found to anticipate the Meitzner-Oline claims if Meitzner-Oline merely recognized that which is inherently disclosed by Mindick. See Application of Best, 562 F.2d 1252, 1254 (C.C.P.A. 1977); Verdegaal Bros. Inc., 814 F. 2d at 633. Brotech attempted to prove this inherency by offering results of tests conducted on resins reproduced by Brotech according to the Mindick patent. Prior art examples may be reproduced to provide evidence relevant to an inherency determination. See Studiengesellschaft Kohle mbH v. Dart Indus., Inc., 549 F. Supp. 716, 725-26 (D. Del. 1982).

In addition to disagreeing with Dr. Abrams on the issue of the express disclosures found in Mindick, Dr. Albright also disagreed with Dr. Abrams that one skilled in the art practicing the Mindick patent would obtain macroreticular resins as set forth in his examples. Dr. Albright based his conclusions on a study he conducted in the late 1960s using varying amounts of divinylbenzene with varying amounts of toluene in an attempt to produce a macroreticular copolymer. The results of Dr. Albright's study are reported in table form in DX 257/PX 2326. According to Dr. Albright's study and conclusions, none of the examples cited by Dr. Abrams as falling within the Meitzner-Oline patents (Examples 1,

52, 53, 58) would result in a macroreticular copolymer. Dr. Albright drew his conclusions regarding the macroreticularity of these resins from the surface area measurements. Resins made with amounts of divinylbenzene and toluene corresponding to Mindick examples 1, 52, 53, and 58 possessed an "unmeasurable" surface area.

Based on the Court's reading of the Mindick patent, the testimony of both parties' experts, and considering both Brotech's reproductions of Mindick examples and Dr. Albright's toluene study, the Court finds that Mindick does not anticipate Claim 1 of the '124 patent.

Brotech has not provided clear and convincing evidence of anticipation. The Court finds that there is no express or inherent teaching of macroreticular resins in the Mindick patent. The expert interpretations of Brotech's reproductions of the Mindick examples were not sufficient to create a clear and convincing showing of anticipation over Rohm and Haas' conflicting expert testimony. Due to the varying possible interpretations, Brotech may not successfully claim that there is an inherent teaching in the Mindick patent. See In re Wilding, 535 F.2d 631, 636 (C.C.P.A. 1976).

4. IRC-50

IRC-50 is a macroreticular resin manufactured by Rohm and Haas since 1948. It is composed of methacrylic acid (MAA) cross-linked with divinylbenzene (DVB). The bead is formed by suspension polymerization. IRC-50 was discovered by accident in a failed

experiment. The accidental creation was given to Dr. Kunin for further analysis. Dr. Kunin discovered that, in its opaque form, IRC-50 had a high capacity for isolating streptomycin from the substance in which streptomycin is made.

Dr. Lyman was assigned the project of developing a reproducible commercial process for manufacturing IRC-50. Although Dr. Lyman was able to produce an opaque IRC-50 in the lab, when the process was transferred to a pilot manufacturing plan, the IRC-50 was clear. A commercial process for manufacturing IRC-50 was implemented in 1948. To this day, however, Rohm and Haas is unable to produce IRC-50 on a consistent basis in its opaque form with its high capacity for isolating streptomycin.

Although it was recognized early on that the opaque form of IRC-50 had particularly good capacity for absorbing large molecules such as streptomycin and Vitamin B-12, the bases for IRC-50's unusual properties was not fully understood until much later, and only then with the hindsight of Meitzner and Oline's work.

Experts called by Rohm and Haas and Brotech disagree as to whether the process used to make IRC-50 employs a precipitant. Brotech contends that the suspending medium acts like a precipitant. According to Rohm and Haas' experts, the suspension polymerization of MAA is maintained using water that has been saturated with salt. Salt makes the MAA monomer insoluble in the aqueous phase. By its nature, the MAA-DVB copolymer is not soluble in its own monomers. Therefore, it spontaneously precipitates out of the monomer mixture as the copolymer is formed. Moreover, Dr.

Albright testified that experiments showed that the less water that was used in the suspension polymerization process, the more opaque the product became. This is contrary to the teachings of Meitzner-Oline that there is a minimum amount of precipitant required to produce opaque, phase-separated resins.

5. Section 102(b) On Sale Bar

Brotech also sought to establish at trial that Rohm and Haas' sale of IRC-50 resins constitutes a statutory bar under 35 U.S.C. § 102(b). Section 102(b) invalidates a patent if the invention was "in public use or on sale" in the United States more than one year prior to the date of the application.

In order to sustain a finding of invalidity under the "on sale" provision of § 102(b), Brotech must prove by clear and convincing evidence that the completed invention was embodied in, or obvious in view of a product offered for sale prior to the critical date. Intel Corp. v. United States Int'l Trading Comm'n., 946 F.2d 829-30 (Fed. Cir. 1991). The intent of Section 102(b) is to "preclude attempts by the inventor or his assignee to profit from commercial use of an invention for more than one year before an application for patent is filed." D.C. Auld Co., 714 F.2d 1144, 1147 (Fed. Cir. 1983).

Where as here, the claimed invention is a process, or even products-by-processes, the focus must necessarily be on the process. If Rohm and Haas produced and sold a product made according to the patented process before the critical date, Rohm and Haas' right to a patent on that process is forfeited. Id.;

Metallizing Eng'g. Co. v. Kenyon Bearing & Auto Parts Co., Inc., 153 F.2d 516 (2d Cir. 1946), cert. denied, 328 U.S. (1946). This is true even if the product does not reveal the process. U.S. Chemical Corp. v. Plastic Glass Corp., 243 F.2d 892 (3d Cir. 1957), cert. denied, 355 U.S. 836 (1957).

Rohm and Haas concedes that IRC-50 was a commercial product that had been sold by Rohm and Haas prior to July 1957, the critical date for the first Meitzner-Oline application. Rohm and Haas contends, however, that IRC-50 was not made according to the process claimed in the Meitzner and Oline patents in suit and therefore the sale of IRC-50 did not place the process invention of Meitzner and Oline on sale within the meaning of § 102(b).

Thus, to determine whether the sale of IRC-50 constitutes a § 102(b) statutory bar, the Court must determine whether or not it was made according to the patented process. See, e.g., Kalvar Corp. v. Xidex Corp., 384 F. Supp. 1126, 1138 (N.D. Cal. 1973), aff'd, 556 F.2d 966 (9th Cir. 1977). The Court finds that IRC-50 was not made using the Meitzner-Oline process inventions. The Meitzner-Oline inventions focus on the suspension polymerization of styrene and DVB using an added third ingredient, the precipitant. Dr. Albright testified that the phase separation found in IRC-50 is not caused by the addition of a precipitant, but occurs due to the insolubility of the copolymer in the monomers involved.

Second, the Meitzner and Oline patents describe a two step process for making ion exchange resins: (1) producing the base copolymer styrene-DVB bead; and (2) functionalizing the bead

with either cation exchange groups or anion exchange groups. In contrast, IRC-50 is made in one step and is available only as a cation exchange resin. There is no base copolymer bead.

Even though IRC-50 was not made according to the Meitzner-Oline patented process, the Meitzner-Oline patents may still be rendered invalid if in view of IRC-50, the Meitzner-Oline claimed process was made obvious. UMC Electronics Co. v. United States, 816 F.2d 647, 656 (Fed. Cir. 1987), cert. denied, 484 U.S. 1025 (1987). This is referred to as the "§§ 102(b)/103 rejection" since its bases reside in application of both sections. See In Re Corcoran, 640 F.2d 1331, 1333 (1981); see also In re Kaslow, 707 F.2d 1366, 1374 (Fed. Cir. 1983) ("a public use or placing on sale under Section 102(b) is prior art which may support an obviousness rejection under Section 103.").

The question to be resolved under the §§ 102(b)/103 rejection is whether the Meitzner-Oline claimed inventions read as a whole would have been rendered obvious by the addition of IRC-50 to the prior art. The critical date for this obviousness inquiry (as opposed to a strict § 103 inquiry) is July, 1957.

As discussed above, Rohm and Haas points out four differences between the process claimed by the Meitzner and Oline and IRC-50. First, IRC-50 is made by crosslinking methacrylic acid with divinylbenzene whereas the definition of the monomers in all Meitzner - Oline claims excludes MAA. Abrams, Tr. at 1220; Albright, Tr. at 2661-62.

Second, the process for making IRC-50 does not use a precipitant, whereas one of the most significant disclosures in the Meitzner-Oline claims is the use of a precipitant to induce phase separation. Absent the precipitant, the monomers disclosed in Meitzner-Oline would copolymerize into gel beads. In contrast, IRC-50 monomers produce a copolymer which by its nature is insoluble in its monomers and therefore, phase separates. Albright, Tr. at 70-71, 87-89, 249, 2654.

Third, upon completion of polymerization, and without further processing, IRC-50 is immediately useable as a cation exchanger, and only as a cation exchanger. Meitzner-Oline, on the other hand, claim a two step process involving first the formation of a non-functionalized copolymer bead and second, functionalization. Thus, Meitzner-Oline provide for the production of a wide range of ion exchange resins with both anion and cation exchange capacities. Kunin, Tr. at 2019-20; Albright, Tr. at 62; Px 2429, pp. 4, 6-7.

Finally, Dr. Lyman testified that the process for IRC-50 works only within a narrow range of conditions, and even then, it is difficult to obtain consistent results. Meitzner-Oline's process allows the production of ion exchange resins under a wide range of conditions enabling the production of a variety of tailor-made products to satisfy many different needs. Albright, Tr. at 93-94.

Viewing the Meitzner - Oline invention as a whole, the Court finds that Brotech has failed to establish by clear and

convincing evidence that the addition of IRC-50 to the prior art rendered the Meitzner - Oline inventions obvious as of July 1957.

C. Obviousness

Section 103 states:

> a patent may not be obtained . . . if the differences between the subject matter sought to be patented and prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

35 U.S.C. § 103 (1988). The Federal Circuit has set forth the criterion necessary for a determination of obviousness:

> whether the prior art would have suggested to one of ordinary skill in the art that this process should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure.

In re Dow Chem. Co., 837 F.2d 469, 473 (Fed. Cir. 1988) (citations omitted).

The Court's determination of obviousness requires resolution of three issues: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; and (3) the level of ordinary skill in the pertinent prior art. Graham v. John Deere Co., 383 U.S. 1, 17 (1966). The Court must also evaluate any secondary considerations such as the commercial success of the patents, long felt but unsolved needs in the art, and the failure of others to solve the problem. Id. at 17-18. As with all defenses of invalidity, Brotech has the burden of proving obviousness by clear and convincing evidence. Custom

Accessories, Inc. v. Jeffrey-Allan Indus., Inc., 807 F.2d 955, 961 (Fed. Cir. 1986).

1. Level of Ordinary Skill in the Pertinent Art

The Court must consider the level of ordinary skill in the art at the time of the claimed invention. The Court must keep in mind the differences between the knowledge available fifteen to twenty years later to prove an argument, and the knowledge available during the time frame in question. See Kloster Speedsteel AB v. Crucible, Inc., 793 F.2d 1565, 1574 (Fed. Cir. 1986), cert. denied, 479 U.S. 1034 (1987); Uniroyal, Inc. v. Rudkin-Wiley Corp., 837 F.2d 1044, 1050-51 (Fed. Cir.), cert. denied, 488 U.S. 825 (1988). An analysis of the level of ordinary skill in the art should incorporate the types of problems in the art, the prior art solutions to the problems, the rapidity of innovations in the field, the sophistication of the technology, the education of the inventor, and the educational level of active workers in the field. Accord Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d at 449-50.

Dr. Abrams testified that the hypothetical person of ordinary skill in the art in 1958 would have been a person with a bachelor's degree in chemistry and three years of hands-on laboratory experience synthesizing ion exchange resins. Abrams, Tr. at 2735-36. The Court accepts this as a reasonable standard upon which to base its conclusions.

2. Scope and Content of Prior Art

The scope and content of the prior art includes printed publications before the invention, as well as prior use or knowledge in the United States. 35 U.S.C. § 102. In addition, the Court should consider any United States patent application subsequently issued, but filed before the invention and any other inventions not abandoned, suppressed, or concealed before the invention. See 35 U.S.C. § 102(a), (e), and (g). Unlike anticipation, obviousness does not require that the prior art strictly identify the elements of the claimed invention, but rather focuses on the general teachings of the field. Application of Foster, 343 F.2d 980, 987-89 (C.C.P.A. 1965), cert. denied, 383 U.S. 966 (1966).

3. Differences Between the Prior Art and the Claims at Issue

The Court must evaluate the differences between the prior art, namely the Abrams' patents and process, IRC-50, the Mindick and Corte patents, and the Meitzner-Oline patents. See Graham v. John Deere Co., 383 U.S. at 17. Rohm and Haas contends that there are sufficient differences between the prior art and the Meitzner-Oline patents to defeat Brotech's claim of invalidity based on obviousness.

a. Abrams Process

Rohm and Haas first identifies differences between the Meitzner-Oline patents and the Abrams' process. Rohm and Haas argues that the Abrams' process involves the formation of the copolymer around added linear polystyrene. Thereafter, the linear

polystyrene is extracted, creating holes. The Meitzner-Oline process differs through use of an organic liquid as a precipitant, which creates clustering of microgel particles. These microgel particles contain "fixed channels or pores."

Dr. Albright, a Rohm and Haas expert, testified in response to a request to describe the Abrams' process stating,

> As I understand it, the material after it had been made, was then functionalized and the linear polystyrene was extracted after functionalization. Functionalization of the linear polystyrene chlormethylation followed by aminolysis made the linear polystyrene soluble, and then it was able to be extracted out with water or the appropriate agents in water, either an acid or base.
>
> Q. What effect, as you understand it, did the removal of the linear polystyrene have on the bead?
> A. It then produced holes in the bead.

Albright, Tr. at 299-300.

Rohm and Haas also contends that product differences are seen as a result of the differing processes. The Abrams' product contains holes where the linear polystyrene has been removed. Rohm and Haas argues that the Abrams' product is comprised of a configuration of internal walls in no definite order, also characterized by low pore volume, low surface area and large holes. Rohm and Haas compares this to the Meitzner-Oline copolymer which consists of a cluster of copolymer gel particles with fixed pores with no specific configuration in the beads, high porosity and high surface area. Brotech, in contrast, argues that the only difference between Abrams and Meitzner-Oline is that Abrams used a

linear polymer and Meitzner-Oline used low molecular weight organic liquids. Abrams, Tr. at 1179-80.

The Court finds that Brotech has failed to establish by clear and convincing evidence that the Meitzner-Oline patents are invalid on obviousness grounds due to the Abrams prior art. The most credible evidence offered by Brotech on the Abrams process was Dr. Abrams who testified that examples produced according to his patent will result in the production of a macroreticular resin. Balanced against this evidence are all the differences pointed out by Rohm and Haas between the Abrams' process and Meitzner-Oline. When combined with the lack of commercial success attributable to Abrams, the Court is convinced that Meitzner-Oline is distinct from the Abrams' process.

b. IRC-50

Rohm and Haas next contends that IRC-50 does not render the Meitzner-Oline patents invalid based on obviousness. Rohm and Haas points to three major differences to support its argument. First, Rohm and Haas claims that the monomers used in IRC-50 are not the same combination as claimed in the Meitzner-Oline patents. Albright, Tr. at 2661-62. Next, Rohm and Haas contends that the IRC-50 process does not utilize a precipitant whereas the Meitzner-Oline patents do use a precipitant. Albright, Tr. at 2661. Finally, Rohm and Haas argues that upon completion of initial polymerization, IRC-50 is a cation ion exchange resin. Rohm and Haas distinguishes this from the Meitzner-Oline patents which allow for a wide variety of IER's. This two step invention begins with

the suspension polymerization process to form the macroreticular copolymer. Thereafter, different anion or cation functionalities can be attached to convert the copolymer. Kunin, Tr. at 2019-20.

Brotech claims that the only difference between IRC-50 and Meitzner-Oline is that IRC-50 uses water as a precipitant. Meitzner-Oline utilizes an organic liquid as precipitant. Kunin, Tr. at 2429. Brotech also argues that the specific monomers used in Meitzner-Oline are not critical to the invention. Brotech argues, in addition, that IRC-50 in view of the Abrams' process, renders Meitzner invalid. Brotech contends that Abrams teaches the use of an organic liquid, rather than water, as precipitant. Brotech contends that it would be obvious to one skilled in the art to combine this teaching with IRC-50, thereby rendering Meitzner-Oline obvious. DX-170, col. 2, 11.59-72.

The Court finds that a combination of Abrams and IRC-50 would not render the Meitzner-Oline patents obvious. Rohm and Haas adduced evidence from two scientists, including Brotech's expert, Dr. Abrams, neither of whom did not or could not produce the Meitzner-Oline invention despite their skill and experience in the field. On the evidence as presented, the Court finds that Brotech has not presented clear and convincing evidence to prove otherwise.

c. Mindick

Rohm and Haas next argues that the Mindick patent and the associated interference counts do not invalidate the Meitzner-Oline patents. Rohm and Haas claims that Mindick and the interference counts only teach copolymers and anion resins of increased

porosity. Rohm and Haas discovered that the addition of toluene to the monomer mixtures resulted in increased water holding capacity. Oline, Tr. at 335-339. Rohm and Haas argues that its scientists, with years of experience, believed that toluene could not act as a precipitant. Because of this, Rohm and Haas argues that it was not obvious to those skilled in the art to use the teachings of Mindick to create a macroreticular resin. Rohm and Haas also refers to Dr. Abrams' admission that one skilled in the art would have understood Mindick's statements about water holding capacity to refer to gel porosity not "macroporosity." Abrams, Tr. at 1310-11; 2871-72.

Brotech contends that the difference between Mindick and Meitzner-Oline is simply characterization. Brotech argues that the description of the products made by the respective processes is not a sufficient difference to defeat Brotech's claim of obviousness.

The Court agrees with Rohm and Haas that the hindsight evidence of Brotech's experts is unavailing when viewed against Rohm and Haas' own experience using toluene. The Court finds that Brotech has simply failed to produce credible evidence of its assertion on this ground.

d. Corte

Rohm and Haas also disputes Brotech's claim that the '535 or '646 Corte patents render the Meitzner-Oline patents invalid due to obviousness. Rohm and Haas contends that Corte does not describe the properties of a macroreticular polymer. Abrams, Tr. at 1214-15, 2863-64; Kline, Tr. at 2152-53. Rohm and Haas suggests, for example, that Corte does not describe phase

separation, precipitation or agglomeration of microgel particles. Id. Rohm and Haas also addresses Corte's lack of reference to internal surface area and apparent density. Rohm and Haas argues that the Corte examples are ambiguous and are subject to various interpretations. Rohm and Haas presented several witnesses who testified regarding the apparent inability to particularly define the structure of the Corte product. See, e.g., Albright, Tr. at 196.

Brotech argues that the only difference between Corte '535 and Meitzner-Oline '124 is that different terms are used to characterize the same thing. Brotech's Finding of Fact 1074. Brotech argues that Meitzner-Oline '840 and '415 are rendered obvious because they simply teach the process for making a copolymer bead. Brotech contends that it would have been obvious to one skilled in the art to functionalize the copolymer of the '535 Corte patent to make a cation instead of an anion exchange resin. Abrams, Tr. at 2760-65. Brotech also discusses the overlap in the Corte patent of the ranges set forth in the '415 patent for the percentage limitations of organic liquid and crosslinker. Brotech provides the results of the reproduction tests it performed on the Corte patent. Brotech claims that each reproduction created a phase separated sample. See Brotech Opening Post Trial Brief, D.I. 651, at 37.

In resolving the competing efforts of Brotech and Rohm and Haas, the Court credits the experience of Rohm and Haas' witnesses. The Court is persuaded that Rohm and Haas' assertion as

to the ambiguity of Corte's teaching to produce a macroreticular resin is well-founded, and more telling than the evidence of Brotech offered in support of its clear and convincing burden of proof.

4. Secondary Considerations

The Court must also consider objective evidence relevant to a determination of obviousness including the commercial success of the patent in suit, the unexpectedness of the results of the patent, the adoption of the patent's idea by others, and licensing of the patent. Stratoflex, Inc. v. Aeroquip Corp., 713 F.2d 1530, 1538-1539 (Fed. Cir. 1983). The prior art must also suggest the desirability of the improvement or modification. Alco Standard Corp. v. Tennessee Valley Authority, 808 F.2d 1490, 1498 (Fed. Cir. 1986), cert. dismissed, 483 U.S. 1052 (1987).

In weighing the factor of commercial success of the patents in suit, the Court is persuaded that this consideration does not contribute to the Court's analysis and for that reason relies on the other factors previously discussed.

D. Interference Estoppel

Brotech also argues that the patents-in-suit are invalid on the grounds of interference estoppel. Brotech contends that Rohm and Haas is precluded from attacking Corte and Mindick with arguments which should have been raised during one of any of the several interferences. Brotech further asserts that the claims of the patents-in-suit are barred by the doctrine of judicial estoppel

in that Rohm and Haas is actually making arguments inconsistent with prior arguments made during the interferences.

1. Background of the Interferences

The '816 Interference, involving Corte and Meitzner-Oline was declared in 1962. The single count in the interference claimed a process for making a "sponge-like" copolymer. Brotech claims that Rohm and Haas admitted during this interference that Corte taught phase separation and that sponge-like and macroreticular meant the same thing. Brotech further claims that Rohm and Haas never raised any issue regarding whether Corte adequately disclosed or taught phase separation or was operable to make phase separated copolymers.[19]

Corte and Meitzner-Oline were subsequently involved in another interference on cation exchange resins. This interference, the '110 Interference, was declared in 1972. Brotech again asserts that at no time during the '110 Interference did Rohm and Haas raise any issue regarding whether Corte '646 disclosed, taught, or suggested a process for making phase separated resins, or that "sponge-like" meant something different than macroreticular or phase separated.

At the time the '816 Interference was declared, the PTO declared a second interference between Meitzner, Corte and Mindick. The '815 Interference was directed to a single count covering the

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19. Rohm and Haas eventually lost this interference and the appeal therefrom, resulting in priority being awarded to Corte. Corte '535 patent later issued from the count of the '816 Interference.

process for making ion exchange resins of increased porosity. Both Corte and Meitzner moved to dissolve the interference on the grounds that the count was too broad and unpatentable to any party. Their motions were granted, and the interference was terminated.

Then, in 1968 the PTO declared another interference between Mindick, Meitzner and Corte. The '314 Interference likewise involved a single count directed to resins of increased porosity. The Commissioner dissolved the interference on the ground of estoppel for failure to litigate issues that should have been raised in the '815 Interference. The Mindick application then issued as the '562 patent.

In 1972, Meitzner provoked a third interference with Mindick by copying Claims 1-4 from the Mindick patent. Mindick moved to dissolve the interference, asserting estoppel against Meitzner-Oline for their failure to contest priority in the earlier interferences. Meitzner moved to add Claims 5-10 of the Mindick patent to the interference. Mindick's motion was denied; Meitzner's motion was granted.

The Board of Patent Interferences reversed the Examiner and awarded priority to Mindick on the grounds of estoppel for Meitzner's failure to contest priority over Mindick in the '815 Interference. The Court of Customs and Patent Appeals affirmed the Board's ruling.

2. Discussion

The doctrine of interference estoppel prevents a party to an interference from raising issues after the resolution of the

interference that could and should have been raised during the interference. See In re Kroekel, 803 F.2d 705, 709 (Fed. Cir. 1986); In re Deckler, 977 F.2d 1449, 1452 (Fed. Cir. 1992). Interference estoppel has been applied as a defense in patent infringement litigation. See Phillips Petroleum Co. v. U.S. Steel Corp., 673 F. Supp. 1278 (D. Del. 1987), aff'd, 865 F.2d 1247 (1989); Typewriters Hilliardized, Inc. v. Corona Typewriter Co., 43 F.2d 961, 964-65 (2d Cir. 1930).

Brotech contends that Rohm and Haas ought to be barred from challenging the operability and adequacy of the disclosure of the Corte '535 patent because Rohm and Haas did not raise any question during the '816 Interference as to whether or not Corte could support a count directed to a process for making phase separated copolymers. Brotech asserts that Rohm and Haas admitted that the Corte application disclosed a process for making a phase separated copolymer. Because Rohm and Haas could have raised the adequacy and operability issues during the Corte interferences, but failed to do so, Brotech seeks to estop Rohm and Haas from doing so now.

Brotech makes a similar argument with regard to Mindick. As Brotech notes, following the conclusion of the interferences, Rohm and Haas was able to overcome rejections based on Mindick by arguing to the Examiner that Mindick did not teach, disclose, suggest or produce phase separated resins. Brotech argues that Rohm and Haas should have been estopped from raising these arguments because they were not raised during the interference

proceedings. Brotech claims that during the interferences, Rohm and Haas took the position that Claims 1-4 (counts 1-4 of the '787 Interference) were directed to phase separated copolymers. Rohm and Haas attempted to win the interference by arguing that Mindick did not have support for claims 1-4 in his original application. Therefore, Brotech argues that since Rohm and Haas had an opportunity, but failed, to challenge whether Mindick taught a process for making phase separated resins, Rohm and Haas should have been estopped during the ex parte prosecution from asserting that Mindick did not teach, disclose, or produce phase separated resins.

Rohm and Haas responds that interference estoppel is not available as a defense to the validity or unenforceability of an issued patent. Moreover, Rohm and Haas asserts that it was not estopped from arguing to the ex parte examiner that Corte and Mindick did not disclose macroreticular resins. Rohm and Haas asserts that the counts in the interferences were not limited to phase separated copolymers, but were much broader. Thus, Rohm and Haas was not obligated during the interferences to raise the issue of whether Corte and Mindick were inoperative to make a macroreticular copolymer. Rohm and Haas returned to ex parte prosecution and was successful in convincing the patent examiner that it was entitled to a narrower invention which is a patentably distinct subgenus of the counts and disclosures of Mindick and Corte.

The Court does not need to resolve the contested legal question of whether interference estoppel is a defense to validity and enforceability of a patent cognizable in patent infringement litigation. Even if interference estoppel were a cognizable defense, it would bar only those claims that are patentably indistinct from the counts involved in the interference, a question that sits at the center of this lawsuit.

The Court has already determined that Mindick's and Corte's disclosures do not teach one skilled in the art how to make a macroreticular resin, and therefore, Meitzner-Oline's invention is not anticipated by Mindick and Corte. Stated alternatively, Meitzner-Oline's invention is patentably distinct from that of Mindick and Corte. Since the counts involved in the interferences were substantially identical to the claims found in the Mindick and Corte patents, the Court likewise finds that the Meitzner-Oline claims are patentably distinct from the interference counts. Accordingly, even if Brotech had available as a defense the doctrine of interference estoppel, such defense is not applicable here.

E. Judicial Estoppel

Brotech also seeks to invalidate the patents-in-suit under the doctrine of judicial estoppel. Judicial estoppel is used to prevent parties "from asserting a contradictory position in a subsequent litigation to one previously asserted in another action." Simplified, Brotech's argument is that during the interference proceedings Rohm and Haas consistently advanced the

position that the inventions disclosed by Corte and Meitzner were identical, that sponge-like and macroreticular were synonymous, and that Corte and Meitzner taught phase separation. Because of these positions taken by Rohm and Haas during the interferences, Rohm and Haas should have been barred from attempting to convince the Examiners in ex parte prosecution that sponge-like and macroreticular are not synonymous, that Corte did not teach or even suggest phase separation. Samick Music Corp. v. Delaware Music Indus., Inc., No. 91-23, slip op. at 5-6 (D. Del. February 12, 1992); Delgrosso v. Spang & Co., 903 F.2d 234, 241 (3d Cir.), cert. denied, 498 U.S. 967 (1990); Lewandowski v. Nat'l R.R. Passenger Corp. (AMTRAK), 882 F.2d 815, 819 (3d Cir. 1989). In judicial estoppel cases, it is not necessary that the party prevail in the prior case, but only that the party gain some benefit from asserting the prior inconsistent position. Delgrosso, 903 F.2d at 241-43. Under settled principles of res judicata and collateral estoppel, lost counts in an interference bar patents on later, patentably indistinguishable claims. In re Deckler, 977 F.2d at 1452.

While the Court has serious questions regarding the manner in which the patents-in-suit were prosecuted, the Court finds that Brotech has not proven that Rohm and Haas argued inconsistent positions during the interference proceedings and in ex parte prosecution.

V. INEQUITABLE CONDUCT

Brotech contends that Rohm and Haas, through its counsel and scientists committed inequitable conduct in prosecution of the three related patents by: (1) misrepresenting that Corte neither disclosed, taught, suggested, nor produced phase separation; (2) misrepresenting that Mindick neither disclosed, taught, suggested, nor produced phase separation; (3) withholding material information from the various patent examiners regarding IRC-50; and (4) otherwise engaging in a pattern of conduct before the PTO with the intent to deceive the patent examiners. Brotech avers that the Rohm and Haas representatives knew of their duty of candor owed to the PTO, and intentionally misled the PTO in order to obtain the patents in suit.

Rule 56(a) of Title 37, Chapter 1 of the Code of Federal Regulations provides that applicants and their attorneys must "disclose to the [PTO] information they are aware of which is material to the examination of the application."[20] 37 C.F.R. 1.56(a) (1989). Applicants for patents and attorneys representing applicants owe the U.S. Patent and Trademark Office a duty of candor, good faith and honesty. FMC Corp. v. Manitowoc Co., Inc., 835 F.2d 1411, 1415 n.8 (Fed. Cir. 1987); Hycor Corp. v. Schlueter Co., 740 F.2d 1529, 1538 (Fed. Cir. 1984); American Standard Inc. v. Pfizer Inc., 722 F. Supp. at 141 (citing Precision Inst. Mfg.

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20. Although Rule 56 was not adopted until 1977, the basic tenets of that rule were in effect in 1973-1974. Manville Sales Corp. v. Paramount Sys., Inc., 917 F.2d 544, 551-552 (Fed. Cir. 1990).

Co. v. Automotive Maintenance Mach. Co., 324 U.S. 806, 818 (1945)).

An applicant or the attorney has a duty to disclose all material information of which they were aware and, any knowledge or action taken by the attorney is considered chargeable to the applicant. FMC Corp. v. Manitowoc Co., 835 F.2d at 1415 n.8. This duty is also applicable to foreign practitioners who represent claims in the U.S. PTO through local firms. Gemveto Jewelry Co., Inc. v. Lambert Bros., Inc., 542 F. Supp. 933, 943 (S.D.N.Y. 1982).

One who alleges inequitable conduct based on a failure to disclose material prior art must show by clear and convincing evidence:

(a) the existence of material prior art or information;

(b) knowledge chargeable to the applicant of the prior art or information and its materiality; and

(c) failure of the applicant to disclose the art or information resulting from an intent to mislead the U.S. PTO.

FMC Corp. v. Manitowoc Co., 835 F.2d at 1415.

For the Court to conclude the presence of inequitable conduct, the Court must first find that certain thresholds of materiality and intent are present. Under Sea Indus., Inc. v. Dacor Corp., 833 F.2d 1551, 1559 (Fed. Cir. 1987). Only if threshold levels of materiality and intent are present must the Court, as a matter of law, determine whether inequitable conduct occurred. Raytheon Co. v. Roper Corp., 724 F.2d 951, 956 (Fed. Cir. 1983), cert. denied, 469 U.S. 835 (1984).

A. Standard of Review

1. Materiality

Information is considered material if "there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent." 37 C.F.R. § 1.56(a); Specialty Composites v. Cabot Corp., 845 F.2d 981, 992 (Fed. Cir. 1988).

An applicant need not disclose all prior art. The applicant need not disclose prior art which is no more pertinent or merely cumulative to that considered by the examiner. Rolls-Royce Ltd. v. GTE Valeron Corp., 800 F.2d 1101, 1107 (Fed. Cir. 1986). Further, if the uncited art is less material than those already disclosed, the applicant and attorney have no obligation to disclose the art in issue. Halliburton Co. v. Schlumberger Technology Corp., 925 F.2d 1435, 1440 (Fed. Cir. 1991).

Likewise, the applicant is not required to disclose information to the PTO that teaches away from the claimed invention. See Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc., 796 F.2d at 448-449; see also Air Prods. & Chems., Inc. v. Chas. S. Tanner Co., 219 U.S.P.Q. 223, 243 (D.S.C. 1983).

The Court must consider all aspects of the patent prosecution to make a determination of a reference's materiality. The starting point for determining the materiality of a reference is the PTO standard and actions taken at the PTO. Solarex Corp. v. Arco Solar, Inc., 805 F. Supp. 252, 287 (D. Del. 1992).

2. Intent to Mislead or Deceive

The Court must also find an intent to mislead or deceive the Patent and Trademark Office to establish proof of inequitable conduct. Hewlett-Packard Co. v. Bausch & Lomb Inc., 882 F.2d 1556, 1562 (Fed. Cir. 1989), cert. denied, 493 U.S. 1076 (1990). Because direct evidence of an intent to deceive rarely exists, the Court may rely on circumstantial evidence leading to an inference of intent to mislead as the basis for a finding of inequitable conduct. Id.

A finding of gross negligence alone, however, is insufficient to infer inequitable conduct. Id. Instead, the Court must view the conduct in light of the totality of the circumstances, "including the nature and level of culpability of the conduct and the absence or presence of affirmative evidence of good faith." Id. (citing Kingsdown Medical Consultants, Ltd. v. Hollister Inc., 863 F.2d 867, 876 (Fed. Cir. 1988), cert. denied, 440 U.S. 1067 (1989)); see also Consolidated Aluminum Corp. v. Foseco Int'l Ltd., 910 F.2d 804, 809 (Fed. Cir. 1990); RCA Corp. v. Data General, 887 F.2d 1056, 1065 (Fed. Cir. 1989).

In FMC Corp. v. Manitowoc Co., Inc., the Federal Circuit held that intent is a question of fact, and

> an applicant who knew or should have known of the art or information, and of its materiality, is not automatically precluded thereby from an effort to convince the fact finder that the failure to disclose was nonetheless not due to an intent to mislead the Patent and Trademark Office; i.e., that, in light of all the circumstances of the case, an inference of intent to mislead is not warranted.

835 F.2d at 1416. Although subjective good faith may prevent the inference of intent, if an undisclosed reference was material and the applicant knew or should have known that the reference was material, a mere denial of bad faith is insufficient. Id.

Once the Court finds that material information existed that was not disclosed to the PTO and an intent to mislead or deceive, the Court must balance the degree of materiality against the degree of culpability. In balancing, materiality and intent are inversely related. Thus, "the more material the omission, the less culpable the intent required, and vice versa." Halliburton Co., 925 F.2d at 1439 (citing N.V. Akzo v. E.I. Dupont de Nemours, 810 F.2d 1148, 1153 (Fed. Cir. 1987)).

B. Corte

In order to prove that Rohm and Haas acted inequitably in front of the PTO in not disclosing to the PTO that Corte taught or suggested phase separation, Brotech must establish that: (1) Rohm and Haas knew or believed during the prosecution of the patents in suit that Corte taught or suggested phase separation; and (2) Rohm and Haas did not disclose their knowledge or belief that Corte taught or suggested phase separation with the intent to deceive the PTO.

Brotech must also establish that this information is material. Given the history of the prosecution of the patents in suit, and the number of interferences declared between the Meitzner-Oline patents and Corte's application or patents, it can hardly be questioned that Rohm and Haas' knowledge or belief that

Corte, Mindick, and IRC-50 were phase-separated is material information that should have been disclosed to the PTO.

Brotech presented the following evidence to prove that Rohm and Haas knew or believed that Corte taught, suggested, or disclosed phase separation:

In late 1958-1959, Dr. Fisher received a copy of the original Corte patent and concluded that Corte had patented the same process that Rohm and Haas was developing. Dr. Fisher had no doubt that Corte taught phase separated resins. Fisher, Tr. 1354-1396. Brotech contends that Dr. Kirk, Dr. Meitzner and Mr. Kline all knew of Dr. Fisher's conclusions. Also in 1959, Dr. Meitzner conducted a patent study of Corte in which Brotech contends Meitzner was aware that Corte discussed phase separation.

Around this time, Bayer began making phase separated resins according to the Corte patents. Rohm and Haas took a license with Bayer in their macroporous resins. On September 11, 1959, Dr. Meitzner, after studying the Bayer work wrote, "Although this patent lacks the more detailed description of solvent requirements both as to type and critical concentration as given in our lengthy application, the Bayer patent undoubtedly discusses features associated with what we ascribe to phase separation." Defense Exhibit 105. Brotech contends that it is unlikely that Dr. Kunin did not receive a copy of this memo.

Brotech also argues that Rohm and Haas misled the Patent and Trademark Office by telling the PTO that Corte was not phase separated or macroreticular. Specifically, Brotech alleges that

upon return to ex parte prosecution following the '110 Interference, Mr. Kline misrepresented that "there is no teaching or even the slightest recognition in the Corte, et al. patent of suspension polymerizing the monomers under conditions such that phase separation is induced." Defense Exhibit 14, page 106. Additionally, Kline represented to the PTO "what is perhaps the most significant about the Corte, et al. patent is its complete absence of the obvious manifestations of phase separation." Defense Exhibit 14, page 284. Brotech also contends that Kline withheld the results of Dr. Fisher's test from the PTO, confirming that Corte teaches and produces phase separated resins.

Next, Brotech contends that Dr. Clemens represented to the PTO that the Corte examples do not achieve phase separation. Dr. Clemens submitted test data on Corte examples 1 and 4 and argued to the PTO that the tests conducted on those samples conclusively established that the Corte copolymer was not macroreticular, i.e. phase separated. Defense Exhibit 14, pp. 296, 300-01. Corte said that the reason they were not phase separated was because they did not use enough precipitant. However, Brotech contends that the examples most likely to have produced phase separation, examples 2 and 3, were never submitted to the PTO.

In response, Rohm and Haas maintains that neither Dr. Meitzner, the corporation, or any of its representatives thought that Corte taught phase separation. Rohm and Haas contends that Dr. Meitzner believed that Corte failed to teach "a minimum critical concentration of crosslinker and solvent" to produce phase

separation. As to its conduct before the Patent and Trademark Office, Rohm and Haas argues that it did not withhold material evidence from the patent examiner.

Rohm and Haas maintains that it provided the Examiner with all the relevant information needed to review its patent including: the Corte reference, the Interference and all related documentation. Additionally, Rohm and Haas contends that it advised the Examiner of the overlap between the claims sought by Rohm and Haas and the claims of the Corte patent, and that Corte could produce a macroreticular resin if the process conditions were carefully selected. Finally, Rohm and Haas contends that it provided the Examiner with all analytical data relevant to Dr. Clemens' reproductions of Corte Examples 1 and 4. Rohm and Haas asserts that it was obvious to the Examiner that reproductions were not done for Examples 2 and 3.

As to Kline's alleged misrepresentations in front of the Patent Examiner, Rohm and Haas concedes that Kline made inconsistent statements, but not in an effort to deceive. Rohm and Haas contends that the inconsistent statements in the Interference record were subsequently disproved by Rohm and Haas' reproduction experiments. Further, Rohm and Haas argues that it did not conceal the damaging statements since the Examiner and the public had access to the record at all times.

The Court finds that while some of Rohm and Haas' omissions regarding Corte were material, Brotech has failed to establish the requisite intent by clear and convincing evidence.

It is the Court's view that the explanations provided by Rohm and Haas are credible and offer a reasonable rebuttal to Brotech's view of the facts.

C. Mindick

As with Corte, in order to prove that Rohm and Haas acted inequitably before the PTO in not disclosing to the PTO that Mindick taught or suggested phase separation, Brotech must establish that: (1) that Rohm and Haas knew or believed during the prosecution of the patents in suit that Mindick taught or suggested phase separation; (2) that Rohm and Haas did not disclose their knowledge or belief that Mindick taught or suggested phase separation with the intent to deceive the PTO.

Brotech must also establish that the omissions and misrepresentations are material. Again, given the history of the prosecution of the patents in suit, the Court finds that Rohm and Haas knew that Mindick taught phase separation and that this was material information that should have been disclosed to the PTO.

Brotech presented the following evidence to prove that Rohm and Haas acted inequitably with regard to what Rohm and Haas knew or believed as to whether Mindick taught, suggested or disclosed phase separation.

On April 9, 1981, Mr. Kline told the Patent Examiner that "... Mindick, et al. merely shows a technique for improving the 'gel porosity' of a gel-type resin rather than forming a new structure by phase separation." DX 14, p. 103. On october 27, 1982, Mr. Kline told the PTO that Mindick never "produced a phase

separated product nor gave any manifestation that one skilled in the art would recognize as phase separation." DX 291.

Next, Brotech contends that in response to the Patent Examiner's request that Rohm and Haas reproduce the Mindick examples, Rohm and Haas submitted test results using only 50% toluene where the patent recited 65% toluene. Brotech's experts testified that 65% toluene would be more likely to result in a phase separated co-polymer than 50%.

In response, Rohm and Haas reasserts that no material evidence regarding Mindick was withheld from the Examiner during the Meitzner-Oline prosecution. First, Rohm and Haas admitted that it was possible to produce a macroreticular resin if all steps in Mindick's Example 58 were followed. However, Rohm and Haas contends that this does not mean that Mindick will inevitably and necessarily produce a macroreticular resin and phase separation, consistently.

Next, Rohm and Haas argues that Dr. Kunin did not misrepresent the results of the 1962 experiment in which only 50% toluene was used. As in Corte, Rohm and Haas argues that the Patent Examiner had all the facts in front of him to make an educated decision: Mindick himself, the Mindick patent, Kunin's affidavit stating the percentage of toluene used. Rohm and Haas maintains that the experiment was performed for use in a different interference in which the amount of solvent needed was approximately 50% by weight.

On this record, the Court finds that while some of Rohm and Haas' omissions regarding Mindick were material, Brotech has failed to establish the requisite intent by clear and convincing evidence. The information that was presented to the patent examiner convinces the Court that the cited omissions were inadvertent and that the patent examiner had sufficient information to make an informed decision.

D. Abrams

Brotech contends that Rohm & Haas committed inequitable conduct by failing to advise the Patent Office that in 1964 Abrams' resins were found to be macroreticular. Brotech argues that once Rohm and Haas discovered that Abrams' resins were macroreticular, Rohm and Haas should have corrected its earlier representations to the Patent Examiner that Abrams' resins differed in kind than those claimed by Meitzner and Oline.

During prosecution of the Meitzner-Oline applications, Rohm and Haas cited and discussed the prior work of Dr. Abrams. A patent awarded to Dr. Abrams as well as an article authored by Dr. Abrams were disclosed. In March, 1960, the Patent Examiner rejected claims 13-24 as unpatentable over Abrams. The Examiner stated, "The product does not become patentable anew each time there is a change in the method of obtaining, or in the degree of, porosity." In response, Rohm and Haas argued that Abrams resins "differ in kind from [Meitzner-Oline's] products in that they possess a specific surface area of appreciably less than one square meter per gram, while [Meitzner-Oline's] resins will exhibit a

specific surface area as high as 72.5 square meters per gram as shown in Table II." In support of its argument that Abrams' patents differed in kind, Rohm and Haas pointed out that the Abrams resins had negligible surface area, whereas Meitzner-Oline's resins showed surface areas as high as 72.5 square meters per gram. The Examiner again rejected claims 13-24 as unpatentable over Abrams. On appeal, Rohm and Haas again argued that Meitzner-Oline's resins differed in kind from Abrams.

Brotech argues that Rohm and Haas subsequently learned that its representations regarding Abrams were wrong, yet never told the Patent Examiners. The Court agrees that internal documents at Rohm and Haas identified resins made according to the Abrams' process as "macroreticular." However, these same documents repeatedly advanced the assertion by Rohm and Haas that the Abrams' process produces a resin of a different type than disclosed by Meitzner-Oline. Abrams resins are described as possessing "swiss cheese" macroreticularity, whereas Meitzner-Oline resins are "agglomerates of microgels." Abrams' process involves leaching out polystyrene, thus leaving behind channels. Meitzner-Oline's process involves the formation of spherical microgels which as the polymer is forming, begin to stick together. The channels are the spaces left between the microshperes of polymer. Contrary to Brotech's arguments, Rohm and Haas scientists continued throughout trial to distinguish Abrams from Meitzner-Oline's invention on this basis.

In light of this evidence, the Court finds that Brotech has failed to prove by clear and convincing evidence that Rohm and Haas misled the PTO with regard to Abrams. Scientists at Rohm and Haas believed that Abrams' process was significantly different, and produced resins that were different in kind from Meitzner-Oline's resins throughout the prosecution of the three Meitzner-Oline patents. Thus, Rohm and Haas had no reason to correct its statement that the resins made according to the Abrams' process were different in kind. Therefore, the Court concludes that the conduct of Rohm and Haas employees during the prosecution of the Meitzner-Oline applications as it relates to disclosures about Abrams was not inequitable.

E. IRC-50

Brotech contends that Rohm and Haas committed inequitable conduct in failing to inform the PTO that IRC-50 was macroreticular, phase-separated, and possessed an agglomerated microsphere structure. A review of the file-wrappers of the three patents in suit reveals that at no time during the prosecution of the patents did Rohm and Haas bring IRC-50 to the attention of the Patent Examiner.[21]

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21. Although Rohm and Haas contends that it disclosed IRC-50 to the Board of Patent Interferences and clearly acknowledged the existence of IRC-50 as a macroreticular resin being sold by Rohm and Haas in its brief on appeal to the CCPA, such disclosures cannot be said to satisfy Rohm and Haas's duty to the Patent Office. Unlike the cases cited by Rohm and Haas, there is no evidence that the PTO was actually aware of Rohm and Haas's sales of IRC-50, much less that it was a macroreticular resin with agglomerated microspheres.

1. Materiality of IRC-50

The Court finds that there is a substantial likelihood that information which demonstrated that IRC-50 had a structure similar to those resins produced by the Meitzner-Oline process, i.e. phase separated, opaque, and comprised of agglomerates of gel microspheres, would have been important to a reasonable patent examiner in determining the patentability of the Meitzner-Oline inventions, and thus material to the prosecution of the Meitzner-Oline patents-in-suit. Each of the Meitzner-Oline patents contain one or more product by process claims. On more than one occasion during the prosecution of the patents in suit, Rohm and Haas relied on the presence of "agglomerates of microshperes" to distinguish the Meitzner-Oline resins from resins made according to other processes. Based on these arguments, it is likely that a patent examiner would consider important, a product in existence that did possess the agglomerates of gel microshperes, whether made by the same process or a different one.

Rohm and Haas argues that IRC-50 was less pertinent than other prior art cited to the PTO. Rohm and Haas contends that Abrams, Corte and Mindick were all more pertinent than IRC-50 because each involved a process for producing macroreticular resins that contained more elements in common with Meitzner-Oline patent claims. For example, Abrams describes using the same styrene-DVB monomer systems as Meitzner-Oline. In addition, he describes the addition of a third element to induce increased porosity. Finally, Abrams disclosed the ability to obtain inert copolymers that could

be activated to form cation or anion exchange resins. IRC-50 on the other hand is not a styrene-DVB copolymer. The process used to manufacture IRC-50 does not involve the addition of a liquid precipitant to induce phase separation. Finally, IRC-50 is a cation exchange resin formed in one step. There is no base copolymer IRC-50 bead capable of being used without the cation exchange groups attached or as an anion exchange resin. Rohm and Haas argues that these differences demonstrate that IRC-50 was of little materiality.

The Court agrees that IRC-50 is not as material as Corte and Mindick with regard to the process steps disclosed in the M/O process. This does not render IRC-50 totally immaterial. IRC-50 is acknowledged to be the only resin of which Rohm and Haas scientists were aware that possessed an internal surface area due to the presence of agglomerates of microspheres. However, given that the Meitzner and Oline claims are written as product by process and process claims, and the fact that IRC-50 is manufactured through a different process, the materiality of IRC-50 is rendered negligible.

2. Rohm and Haas Knowledge of IRC-50's Materiality

In addition to proving that the information regarding IRC-50 would have been material, Brotech must also prove by clear and convincing evidence that Rohm and Haas knew of the materiality of IRC-50 and intentionally chose not to disclose it. To this end, Brotech cites a number of internal Rohm and Haas memoranda, as well

as published articles authored by Rohm and Haas scientists Dr. Kunin, Dr. Kun and Dr. Storey.

One of the more significant reports relied upon by Brotech is a November 4, 1957 report authored by Dr. Meitzner, described at trial as the "conception report." In this report, Dr. Meitzner reviews the work leading up to the invention of induced phase-separated resins. In particular, Dr. Meitzner reviews in great detail, the discovery of IRC-50, the properties of IRC-50, and Rohm and Haas's current state of knowledge regarding the unusual capacities exhibited by IRC-50. In the summary section of the report, Dr. Meitzner observes that "the formation of opaque IRC-50 has been pointed out as a case of phase separation during polymerization; this may serve as a clue to the understanding of IRC-50 properties." Brotech points to this statement as evidencing Dr. Meitzner's knowledge that IRC-50 was phase separated.

The Court disagrees. Brotech reads too much into this statement. The Court reads this statement as nothing more than inventive theorizing. This conclusion is supported by the testimony of Rohm and Haas scientist Dr. Lyman, who developed the commercial process for manufacturing IRC-50. Dr. Lyman never understood IRC-50 to be phase separated or comprised of agglomerates of microshperes until much after, and with the benefit of, Dr. Meitzner's discoveries. Dr. Kunin and Mr. Oline likewise agreed that no one at Rohm and Haas understood that IRC-50 was macroreticular or possessed internal surface area.

Although Rohm and Haas did not know IRC-50 was phase separated at the time Meitzner and Oline filed their patent application, the Court finds that Rohm and Haas subsequently became aware that IRC-50 possessed internal surface area in 1964. In 1964 Dr. Kunin learned through examination of IRC-50 by electron microscopy that IRC-50 was indeed phase separated and possessed a structure resembling those made according to the Meitzner-Oline process, i.e. agglomerated gel microspheres. Dr. Kunin, Dr. Albright and Mr. Kline all agreed that this was important information for the patent examiner.

3. Rohm and Haas' Intent To Deceive

The question for the Court, therefore, is, did Rohm and Haas not tell the patent examiner about this 1964 discovery in an attempt to deceive the examiner. The Court finds that Brotech has failed to establish by clear and convincing evidence that Rohm and Haas kept this information from the PTO with an intent to deceive the PTO.

The only evidence that Brotech presented in its attempt to prove that Rohm and Haas intended to deceive the PTO, is the fact that when Rohm and Haas submitted the November 26, 1957 report written by Dr. Meitzner to the Board of Patent Interferences, Rohm and Haas redacted the passages that referred to IRC-50 on pages 1 and 2. Thus, according to Brotech, eliminating any text that would lead the PTO to realize that IRC-50 was prior art.

Although, this action may be an indication of the requisite intent, the Court is not persuaded by this evidence alone, particularly in light of the substantial and credible evidence of good faith on the part of Dr. Kunin, Mr. Kline, Dr. Meitzner and Mr. Oline. Mr. Kline, Rohm and Haas's attorney, testified that he did not disclose IRC-50 because it was his opinion that it wasn't prior art and that in his view, IRC-50 was not as relevant as the Abrams' process and products.

Mr. Kline believed that IRC-50 was not a prior art reference for purposes of anticipation and obviousness because the process used to make IRC-50 remains non-public, and one cannot determine the process from examining the product. Moreover, Mr. Kline testified that for the reasons outlined above, he believed and continues to believe that Abrams is the closest, most pertinent prior art to the Meitzner-Oline invention. The Court finds Mr. Kline's explanations credible and reasonable under the circumstances. Therefore, the Court finds that Mr. Kline did not intend to deceive the PTO in not disclosing to the PTO that IRC-50 had agglomerates of gel microspheres.

The Court having found the requisite intent to be lacking, the Court concludes that Rohm and Haas did not act inequitably during the prosecution of the patents in suit on the basis of its failure to cite IRC-50 to the PTO.

VI. CONCLUSION

For the reasons discussed, the Court concludes that after a consideration of all the evidence adduced at trial the '124, '840, and '415 patents are valid and enforceable. However, the Court also concludes that Rohm and Haas has failed to prove that Brotech's products infringe any of the three patent and, accordingly, the Court makes no findings on the issue of damages.

The parties shall submit a Proposed Form of Order no later than July 15, 1995.